

THE EFFICACY OF STRAIN
COUNTERSTRAIN MOBILIZATION
IN PATIENTS WITH PAINFUL
HALLUX ABDUCTO VALGUS BUNIONS.

by

MARIE' BROODRYK

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I, Marie' Broodryk, do hereby declare that this dissertation is
representative of my own work both in conception
and execution.

Marie' Broodryk ✓

4/7/2000
Date

Approved for final submission

Dr R. Mathews M.Tech.C, M.C.A.S.A., C.C.F.C.

4-7-2000
Date

DEDICATION

I dedicate this work to my life and inspiration: my family; Dad and Michelle.

Words could never begin to express my gratitude for your continual support, encouragement and most importantly; your unconditional love.

To my 'newest' family members; Moira, Craig and Kendra, thank you for always being there for me.

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ABSTRACT

The purpose of this prospective, randomised, placebo controlled study was to determine the efficacy of strain counterstrain mobilization in patients suffering with painful Hallux Abducto Valgus Bunions (HAVB). The mobilization group received strain counterstrain mobilization while the placebo group received placebo laser. The study involved sixty patients; thirty in each group, which were selected from the general population. Each patient was treated five times within a three week period.

Each patient was evaluated in terms of subjective clinical findings by means of the Numerical Rating Scale-101, the short-form Mc Gill Pain Questionnaire and the Foot Function Index. Objectively, the patient's pressure-pain tolerance was assessed by means of an algometer. Assessments were taken at the first, third and fifth consultations for all the subjective and objective measurements.

Statistical analysis was completed under the guidance of the statistician at Technikon Natal, at a ninety five percent confidence interval. The parametric two-sample paired test and the non-parametric Wilcoxon sign-rank tests were used to analyse data within each group, while the parametric two-sample

unpaired t-test and non-parametric Mann-Whitney unpaired U tests were used to analyse the data between each group.

In terms of the patients' objective response to treatment, both groups showed significant increase in pressure-pain tolerance levels (algometer readings), but the mobilization group was more effective in the early stage of treatment.

In terms of the patients' subjective response to treatment, only the mobilization group showed a significant decrease in pain perception (NRS-101 scores), while both groups showed a significant decrease in pain perception (Mc Gill scores) and foot pain and disability (Foot Function Index scores). Furthermore, the placebo group was more effective than the mobilization group in the last treatment interval (between the third and fifth treatments) in decreasing pain perception (Mc Gill scores) and foot pain and disability (Foot Function Index scores).

Therefore, it was concluded that strain counterstrain mobilization of the hallux was effective in decreasing the pain associated with painful Hallux Abducto Valgus Bunions, albeit only in the early stages of treatment.

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ABBREVIATIONS USED IN CHAPTER FOUR

NRS-101	-	Numerical Rating Scale-101
Mc Gill	-	Short-form Mc Gill Pain Questionnaire
FFI	-	Foot Function Index
P-v	-	p-value
Sd	-	Standard deviation
Se	-	Standard error
Me	-	Mean

DEFINITION OF TERMS

Strain counterstrain mobilization

Strain counterstrain mobilization is relieving spinal or other joint pain by passively putting the joint into its position of greatest comfort (Jones, 1992).

Placebo

A dummy treatment administered to the control group in a controlled clinical trial in order that the specific and non-specific effects of the experimental treatment can be distinguished (Dorland and Newman, 1988: 1299). For the purpose of this study the placebo therapy will be the application of laser set at zero joules i.e. no actual laser input.

Trigger Point

A focus of hyper irritability in a muscle or its fascia that is symptomatic with respect to pain. It refers a pattern of pain at rest and/or in a motion that is specific for muscles (Travell and Simons, 1992: 4).

Algometer

This instrument measures the patient's sensitivity to pressure in terms of kilograms per square centimetre (Fischer, 1986).

Hallux Abducto Valgus(HAV)

This refers to a common deformity involving a prominence of the medial aspect

of the first metatarsal head and a lateral deviation of the big toe (Levy and Hetherington, 1990).

Bunion

A bunion complex is composed of three components; (a) the big toe angulates laterally towards the second toe, (b) the medial portion of the first metatarsal head enlarges, and (c) the bursa over the medial aspect of the first metatarsophalangeal(MTP) joint becomes inflamed and thick-walled (Calliet, 1997: 163).

Pain Tolerance

This is the maximum localized tenderness elicited using algometric pressure, which is tolerated by an individual under clinical conditions (Fischer, 1987) i.e. sensitivity to pain.

Subjective Clinical Findings

Those findings obtained from the subject in response to the NRS-101, the short-form McGill Pain questionnaire and the FFI.

Objective Clinical Findings

Those findings obtained from recording the patient's pressure-pain tolerance using an algometer.

Valgus

An everted position (Brantingham, 1999) i.e. rotation of the foot away from the mid-sagittal plane.

CHAPTER ONE: INTRODUCTION

1.1 INTRODUCTION

Hallux Abducto Valgus (HAV) is the diagnosis given to a common deformity which involves a prominence of the medial aspect of the first metatarsal head and a lateral deviation of the great toe, which in severe cases may even roll into valgus (Levy and Hetherington, 1990). In articles by Brantingham *et al.* (1994) and Cmons (1999), they mention that although the terms HAV and bunion are often used synonymously (and hence use of the abbreviation HAVB in this study), it should be noted that a bunion refers to the callus and inflamed bursa which overly the HAV deformity.

HAVB is reported to be a common deformity (Brantingham *et al.*, 1994) particularly amongst elderly women (Calliet, 1997) who have a history of wearing high-heeled shoes with pointed toe boxes (Reid, 1995:148).

According to Klaue *et al.* (1994) and Brantingham *et al.* (1994), the controversy concerning the aetiology of HAVB probably arises from the fact that HAVB is caused by a multitude of structural and functional abnormalities, rather than a

single entity.

Although conventional treatment of HAVB is surgery, limitations do exist as is evidenced by patients who suffer with post-operative complications such as painful scar and shortening of the big toe (Khan, 1996). Furthermore, Jahss (1991) even suggests that of the approximately one hundred and twenty five surgical procedures that exist for the treatment of HAVB, most are biomechanically unsound. In addition to this, Reid (1995:149) states that surgery should rather be avoided or kept to a minimum in active individuals and young athletes while Khan (1996) maintains that HAVB surgery in elderly or diabetic patients is contraindicated. These facts therefore indicate a need for a painless, non-invasive treatment for HAVB (Khan, 1996).

Of the conservative therapies used in the treatment of HAVB, most are supported by evidence largely based on non-experimental and uncontrolled clinical observations. However, the usefulness of these conservative therapies still remain questionable (Groiso, 1992).

One of these conservative therapies is strain counterstrain mobilization.

According to Jones (1992), the founder of strain counterstrain mobilization, for each musculoskeletal or neuromuscular dysfunction (such as HAVB), a tender point exists for which there is consistently a position that will relieve it.

D`Ambrogio and Roth (1997) explain that by placing the involved tissues in an ideal position of comfort, the irritability of the tender point is reduced and the tissues associated with the dysfunction are normalised. Although strain counterstrain mobilization appears to be an effective modality for a variety of disorders (D`Ambrogio and Roth, 1997), there are very few randomized, controlled trials demonstrating these claims (Radjeski *et al.*, 1998) and in fact there seem to be no studies specifically focussed on the treatment of HAVB.

1.2 AIM

The aim of this placebo controlled study was to evaluate the efficacy of strain counterstrain mobilization, in terms of subjective and objective clinical findings, in the treatment of painful Hallux Abducto Valgus Bunions (HAVB).

1.3 OBJECTIVES

1.3.1 OBJECTIVE ONE

The first objective was to evaluate the efficacy of strain counterstrain mobilization, in terms of subjective clinical findings, in the treatment of painful Hallux Abducto Valgus Bunions (HAYB).

1.3.2 OBJECTIVE TWO

The second objective was to evaluate the efficacy of strain counterstrain mobilization, in terms of objective clinical findings, in the treatment of painful Hallux Abducto Valgus Bunions (HAYB).

1.4 HYPOTHESES

1.4.1 HYPOTHESIS ONE

It was hypothesised that strain counterstrain mobilization of the hallux would be effective in decreasing the pain in patients with painful Hallux Abducto Valgus Bunions (HAYB).

1.4.2 HYPOTHESIS TWO

It was hypothesised that strain counterstrain mobilization of the hallux would be more effective than a placebo treatment in the management of patients with painful Hallux Abducto Valgus Bunions (HAVB).

CHAPTER TWO: LITERATURE REVIEW

2.1 INTRODUCTION

Hallux Abducto Valgus (HAV) and its associated condition, bunion, is a complex progressive deformity of the first metatarsophalangeal (MTP) joint (Khan, 1996), which may involve the following conditions (Klenerman, 1991):

- rotation of the hallux
- metatarsus primus varus
- overriding of the hallux and second toe
- overriding of the lateral toes
- metatarsalgia
- hammer and claw deformities of the lateral toes, and
- bunionette of the fifth metatarsal

Although the terms HAV and bunion are used to indicate the same condition (Brantingham *et al.*, 1994), a bunion; derived from the Latin word *bunio*, meaning turnip (Cimons, 1999), is in fact the medial prominence of the first metatarsal head. The adventitious bursa overlying the medial aspect of the first MTP joint becomes inflamed, gradually thickens and may ultimately calcify (Calliet, 1997).

For the purpose of this study the term Hallux Abducto Valgus Bunions (HAVB) will be used to indicate the combination of these two closely integrated conditions.

2.2 EPIDEMIOLOGY

Although various authors suggest that HAVB is a common deformity (Brantingham *et al.*, 1994; Cimonis, 1999 and Levy and Hetherington, 1990), there are few statistics available which indicate just how common it is. Based on the opinions of Hatstrup and Johnson (1985) in a review of HAVB, they estimate that the condition is present in three to seventeen percent of the population depending on age. It would appear that there is an increased incidence in women (Levy and Hetherington, 1990), particularly amongst elderly females (Calliet, 1997), presumably due to the irritating effects of their narrow, high-heeled footwear (Klenerman, 1991). This is confirmed by Jahss (1991), who states that in his opinion, it is the use of these high- heels and pointed toe boxes which may account, at least in part, for the 9 : 1 greater incidence of HAVB in females. The validity of such claims remain questionable as they appear to be based on practical experience rather than scientific research. In addition to this, Klenerman (1991) explains that the incrimination of shoe fashion is

based on two arguments: the great number of females affected by HAVB and the remarkably low incidence of the condition amongst unshod people compared with shoe-wearers in the same community. According to Klenerman (1991), as much as ninety percent of all cases presenting for HAVB surgery are female. This figure is presumably based on the vast clinical experience of the author rather than scientific evidence.

2.3 ANATOMY

Unaided support and bipedal locomotion are the two main functions of the human foot (Reid, 1995:129). A combination of the twenty eight bones and fifty five articulations in the foot (Michaud, 1993) result in flexibility with overall stability which provide a flexible lever for locomotion alternating with a rigid structure for support (Magee, 1992:448).

The MTP joints of the foot are condyloid, synovial, biaxial joints (Wadsworth, 1988) thus permitting motion in multiple planes (Reid, 1995:138) namely; flexion, extension, adduction, abduction and circumduction (Moore, 1992:493). Axial elongation is also permitted (Brantingham, 1994). The vertical axis of the MTP joint allows for flexion/extension movements while the transverse axis permits the adduction/abduction movements (Michaud, 1993). Sagittal plane motion at the

first MTP joint is extremely important for normal locomotion (Michaud, 1993) but since locomotion requires very little lateral mobility, some believe that the range of adduction and abduction are of no functional significance during the gait cycle (Wadsworth, 1988 and Michaud, 1993). The closed packed position for these MTP articulations is full extension while resting position is at ten degrees of extension (Magee, 1992:449).

The first MTP joint is the largest of the MTP articulations due to the size of the head of the first metatarsal bone. This is directly related to the large degree of dorsi flexion of the hallux which occurs during walking (Moore, 1992:493).

According to Reid (1995:130) the maximum force acting across the first MTP joint is approximately equal to the body weight, which is more than twice the load carried by the other toes combined. Collateral, plantar and deep transverse ligaments support the MTP joints (Wadsworth, 1988) and strengthen the fibrous articular capsules which surround each joint (Moore, 1992:493). The plantar surface of the capsule of the first MTP joint is reinforced by a fibro cartilaginous plate forming the plantar ligaments (Moore, 1992:493) which contain the medial and lateral sesamoids (Reid, 1995:138). These ligaments are continuous with the plantar aponeurosis which cause stabilisation of the foot's medial longitudinal

arch at toe dorsi flexion by tensing the fascia (Wadsworth, 1988).

2.4 BIOMECHANICS OF THE FIRST MTP JOINT

It is Jahss's (1991) understanding that by altering both the geometry of the foot and the external forces placed on it, HAVB has an effect on the normal biomechanics of the foot.

The first MTP joint plays an important role during the propulsive phase of gait (Levy and Hetherington, 1990) and it must accommodate a wide range of motion for the foot to perform various tasks (Nordin *et al.*, 1989). Normal locomotion requires that dorsi flexion (sixty to ninety degrees) be greater than plantar flexion (forty to fifty degrees)(Wadsworth, 1988). It is suggested that normal ambulation in the general population requires a minimum of sixty to sixty five degrees of first MTP joint dorsi flexion (Wadsworth, 1988); approximately ninety degrees in athletes and as much as one hundred degrees in ballet dancers (Jahss, 1991).

Analysis of hallux motion in the sagittal plane (i.e dorsi flexion and plantar flexion) reveals that the movement centres fall in the metatarsal head in the absence of

foot pathology (Nordin *et al.*, 1989). The resultant movement on walking is a gliding motion between the metatarsal and proximal phalanx, parallel to the joint surfaces. On development of HAVB, the hallux assumes an abnormal position so that the location of the movement centres are altered, causing the motion between the metatarsal and proximal phalanx to become jammed and grossly limited in comparison to a normal foot (Nordin *et al.*, 1989). This results in decreased first MTP joint dorsi flexion, which is essential for normal gait (minimum of sixty degrees dorsiflexion).

Within a normal first MTP joint, the action of the long and short extensor muscles (situated dorsally) are counteracted by the long and short flexor muscles (situated ventrally). This is also the case with the adductor hallucis and abductor hallucis muscles which are antagonists (Donatelli, 1990). As the HAVB deformity develops, the first metatarsal adducts while the phalanx displaces laterally (Yale, 1987). As a result, the adductor hallucis develops a contracture and the long extensors and flexors become laterally displaced. In addition, the abductor hallucis also becomes laterally displaced under the great toe so that it no longer exerts an opposing force to the adductor hallucis (Reid, 1995:149).

Based on Yale`s (1987) opinion, the muscles around the hallux then function to

maintain and increase the deformity of HAVB. However, due to the lack of scientific evidence to confirm this claim, these muscles could even function to stabilise the hallux and prevent further deterioration of the deformity.

2.5 AETIOLOGY

According to Klaue *et al.* (1994) and Brantingham *et al.* (1994), HAVB is an extremely complex deformity with a multi factorial aetiology, which has ultimately caused a great deal of controversy with regards to treatment protocols (Klaue *et al.*, 1994). In order to simplify matters, the aetiology will be discussed under the following categories:

- genetic factors
- mechanical factors
- other factors

Genetic Factors

Yale (1987) is of the opinion that approximately thirty percent of HAVB deformities are of congenital origin or of hereditary predisposition, while Klenerman's (1991) experience suggests that sixty percent is a more accurate estimate. As both of these figures are presumably based on years of practical experience and observation rather than scientific research, it may account for

the vast difference between the two opinions.

Structural malformations such as a rounded first metatarsal head, obliquity of the first MTP joint and /or an elongated hallux may cause lateral migration of the hallux on the metatarsal head, thus precipitating HAVB (Brantingham et al., 1994 and Calliet, 1997). Structural abnormalities are more likely to cause HAVB when combined with certain functional aberrations such as an excessively low medial longitudinal arch, an increased range of dorsi flexion of the first MTP joint (Brantingham et al., 1994), excessive subtalar pronation and muscular imbalance (Klenerman, 1991). According to Michaud (1993) all of these abnormalities compromise the mechanical stability of the first MTP joint.

Generalised joint laxity seen in hyperlax joint disorders such as Down's and Ehlers-Danlos Syndromes, lead to an exaggerated form of hyper mobile pes planus or splayfoot which are implicated in the aetiology of HAVB (Jahss, 1991).

Mechanical Factors

While wearing shoes allows for a whole new range of activities, it also influences normal foot function and it causes unusual stresses on the foot. This is particularly true of current times as shoes are designed to meet the demands of

fashion instead of function (Klenerman, 1991). Reid (1995) is of the opinion that the high-heels and pointed toe boxes characteristic of fashionable shoes, have lead to an increased occurrence of HAVB in women. Yale (1987) also proposes that small or tight-fitting socks or stockings are capable of creating abnormal stress which predisposes to HAVB. Although the author does not offer an explanation for these claims, it is presumed that the socks and stockings have the same biomechanical effect as tight, narrow or pointed shoes when worn for a prolonged period.

Based on an article by Quirk (1994), it was found that ballet dancers with a natural tendency towards HAVB, seemed to deteriorate much faster as a result of wearing special "pointe" shoes and from dancing "sur les pointes" i.e. dancing on the tips of their toes. This may indicate that a combination of inappropriate shoes and a hereditary predisposition to HAVB may result in rapid deterioration of the deformity.

Other Factors

Deformity of the first MTP joint induced by changes following gout, rheumatoid arthritis, infectious arthritis, traumatic arthritis and neurological lesions can

also precipitate HAVB (Yale, 1987). Finally Klenerman (1991) sites obesity, contracture of the Achilles complex and iatrogenic HAV following amputation of the second toe as rarer causes of HAVB.

2.6 PHYSICAL FINDINGS

On examination of the patients presenting with HAVB, the most consistent finding is enlargement of the medial aspect of the first metatarsal head (Levy and Hetherington, 1990). Brantingham (personal communication, 1999) states that abduction of the hallux and an increased space between the first and second metatarsals can also be observed. According to Levy and Hetherington (1990) the range of the first MTP joint may be painful or limited however this is not the view shared by Klenerman (1991), who notes that even in gross cases of HAVB, the passive dorsi flexion of the first MTP joint can be found ranging between thirty to ninety degrees. In moderate to severe cases, the big toe nail faces medially and the hallux may eventually lie everted under the second toe (Brantingham *et al.*, 1994). In a study involving one hundred and twenty two children aged between nine and ten years, Kilmartin *et al.* (1994) observed that even though HAVB initially only affected the first MTP joint, it eventually involved the whole forefoot leading to plantar callosities, deformity of the great toe nail,

forefoot splaying and problems with shoe fitting.

2.7 SYMPTOMS

The main presenting complaints include pain and an inability to wear shoes comfortably (Levy and Hetherington, 1990). Amongst children and teenagers with HAVB, the main reason for seeking treatment seems to be the appearance of the prominent metatarsal head which causes concern for the patient or the family (Groiso, 1992). In some cases where the patient's mother has suffered from HAVB, Klenerman (1991) has observed that the mother often seeks medical advice early due to concerns that the child's feet may deteriorate cosmetically. The pain is usually situated over the medial prominence of the first MTP joint or on the plantar aspect where it is related either to metatarsalgia of the first metatarsal head or to arthritic changes in the sesamoid articulation (Klenerman, 1991). Chiropractors have reported that HAVB may cause secondary symptoms such as general metatarsalgia (Brantingham *et al.*, 1994).

2.8 DIAGNOSIS

The use of anteroposterior (AP), weight bearing radiographs are commonly used

to evaluate the HAVB deformity (Klenerman, 1991; Levy and Hetherington, 1990 and Sammarco and Russo-Alesi, 1998). According to Levy and Hetherington (1990), radiographic measurement of clinically significant angles, namely; the Hallux Abductus (HA) angle and the Hallux Interphalangeal (HI) angle, aid in determining the extent of the deformity while Donatelli (1990) states that the Intermetatarsal Angle (IM) may also be beneficial in determining a treatment protocol. The HA angle is formed by the intersection of the longitudinal axis of the first metatarsal and the longitudinal axis of the proximal phalanx of the hallux, while the HI angle is formed by the intersection of the longitudinal axes of the proximal and distal phalanges of the hallux (Donatelli, 1990). The IM angle is the angular relationship between the first and second metatarsals, according to Donatelli (1990).

There does not appear to be consensus in the literature regarding normal and abnormal values for these angles. According to Donatelli (1990), HAVB is present when the HA angle exceeds fifteen degrees and the HI angle exceeds ten degrees. This is not the view shared by Sammarco and Russo-Alesi (1998) in a surgical review of sixty nine HAVB patients ranging between twenty four and eighty one years of age. In this review all patients had a HA angle greater than twenty

degrees and a HI angle greater than ten degrees. In a study using one hundred and twenty two children between the ages of nine and ten, Kilmartin *et al.* (1994) only chose to include those children who had a HA angle greater than fourteen and a half degrees. Groiso's (1992) selection criterion for fifty six children between one month and sixteen years with HAVB included a HA angle of at least fifteen degrees and a HI angle of at least nine degrees. In all of these studies no explanation was offered to account for the use of different HA and HI angles.

2.9 TREATMENT

The primary objective in the treatment of HAVB, according to Levy and Hetherington (1990), should be the alleviation of pain. In following with the complex aetiology of the condition, Levy and Hetherington (1990) maintain that "there is no such thing as a simple bunion" and thus neither is the treatment. For this reason Yale (1987) suggests that treatment of HAVB depends on the degree of deformity, the extent of pathology and the presence of complicating factors. The treatment protocol should also be tailored to meet the needs of the individual according to the age of the patient as well as to the severity and duration of the symptoms (Calliet, 1997).

Although Calliet (1997) maintains that an individual with a family history of HAVB and who develops the deformity before the age of twenty should be treated conservatively and prophylactically, no scientific evidence is offered to substantiate this claim. This is perhaps due to the fact that the author is of the opinion that invasive treatment would only be beneficial after fusion of the epiphyseal plates. This is probably the same reasoning used by Kilmartin *et al.* (1994) as they are of the opinion that the value of treatment in younger HAVB patients is uncertain.

2.9.1 HOMEOPATHIC MEDICATION

In a double-blind, placebo controlled study involving sixty patients, Khan (1996) found that *Tagetes patula* plus a protective cavity pad which held the tincture in place, significantly reduced the width of the lesion on radiographic evaluation as well as the pain of patients with HAVB. It was recommended as an alternative treatment for patients who do not respond to other treatments.

2.9.2 ORTHOTICS AND FOOTWEAR

Various authors (Brantingham *et al.*, 1994; Cimon, 1999 and Yale, 1987)

advocate the use of accommodative orthoses in addition to well-fitting footwear as part of a comprehensive, conservative treatment of HAVB. Together they aim to restore mechanical stability and redistribute plantar pressure patterns by correcting hyper pronation (Cimons, 1999). Reid (1995:149) places great importance on footwear by saying that "poor footwear will nullify any therapeutic effort". Kilmartin *et al.* (1994) conducted a prospective, placebo controlled trial on one hundred and twenty two children between the ages of nine and ten to determine the effect of an in-shoe arch support. The results indicated an increase in the HA angle, particularly in the treatment group which lead the researchers to conclude that their orthoses should be avoided as they increased the rate at which the HAVB progressed. The researchers felt that the reason for this, in spite of the randomised selection procedure, was that the treated group entered the trial with a significantly greater average HA angle than the control group. They also noted that HAVB deteriorates in children between ten and fourteen years regardless of whether they wear biomechanical orthoses or well-fitting shoes.

2.9.3 SPLINTING

Night splints which abduct the first metatarsal and adduct the two phalanges are indicated as an effective modality especially in children with flexible forefeet

suffering with HAVB (Yale,1987 and Calliet, 1997). A study by Groiso (1992) using a thermoplastic night splint combined with active and passive exercises on a group of fifty six children with juvenile HAVB, showed that the HA angle or the HI angle or both improved satisfactorily in fifty percent of the feet. The validity of these results are questionable as they were not statistically analysed and it is noted that this treatment continued for at least two years. In addition, it is not known how effective the treatment is at relieving pain, as only a change in deformity was recorded.

2.9.4 CHIROPRACTIC INTERVENTION

According to literature which dates back to at least 1906, D.D. Palmer adjusted the first MTP joint for the relief of pain associated with HAVB deformity (Keating *et al.*, 1992) and adjustments for HAVB have been consistently advocated for the condition ever since then, maintains Brantingham (personal communication, 1999). Brantingham *et al.* (1994) found it was their common experience that although manipulation of the bunion joint itself was effective in relieving pain, it did not change the deformity. These claims are presumably based on the combined practical experience of the authors as no mention was made of clinical trials to substantiate this opinion.

2.9.5 OTHER FORMS OF TREATMENT

Active and passive exercises, particularly toe-strengthening exercises have been prescribed for the treatment of HAVB (Cimons, 1999 and Calliet, 1997), however it is Calliet's (1997) opinion that their effectiveness is of questionable value. Reid (1995:149) makes use of a combination of carefully taught intrinsic foot exercises and foot baths in early, mild cases of HAVB only.

In addition to these therapies, Yale (1987) advocates the use of low-voltage electrical stimulation, latex bunion shields and shoe stretching devices which are placed into leather shoes overnight to stretch the toe box of the shoe. Even though these treatment modalities may have some therapeutic value, no conclusive scientific evidence supporting these claims exist.

2.9.6. SURGERY

Although traditional treatment for HAVB is surgery (Khan, 1996), it remains a controversial issue. When considering the multi factorial aetiology of HAVB, the rationale of currently applied surgical techniques have not been conclusively demonstrated (Klaue et al., 1994). This is the view shared by Kilmartin et al. (1994) who state that there is no agreement about the ideal procedure,

optimum age or indications for surgery for HAVB. Yale (1987) however, maintains that surgical intervention is indicated where marked deformity, bony proliferation and pathology of the joint exist. While some surgical procedures are well established, others are difficult to assess as they lack long-term results (Klenerman, 1991). Jahss (1991) states that surgery often leads to post-surgical complications such as joint stiffness, aseptic necrosis, iatrogenic neuromas or pulmonary emboli.

In one of the few prospective, randomised surgical trials, Klosok *et al.* (1993) compared the Chevron and Wilson metatarsal osteotomies and found a decrease in the HA angle and an increase in the first MTP joint range of motion in both groups post-surgically. There was however a significant incidence of complications noted.

A retrospective review of thirty six HAVB patients by Markbreiter and Thompson (1997) compared the Crescentic and Chevron procedures. Results in the Crescentic group showed an average decrease in the HA and HI angles to be 26.2 and 10.2 degrees respectively, while an average decrease of 19.7 degrees in the HA angle and 9.7 degrees in the HI angle were noted in the Chevron group. The progress of patients in the Crescentic group was followed for an average of five years while those patients in the Chevron group were monitored over an average

period of 21.4 months. Although the authors concluded that both procedures are excellent and predictable, it is possible that the difference between the groups may be due to the fact that patients in the Crescentic group entered the trial with a higher average HA angle and were monitored for a longer period post-surgically.

After retrospectively studying seventy two cases of HAVB correction using the Proximal Chevron osteotomy, Sammarco and Russo-Alesi (1998), recorded improvements in the HA and HI angles as well as the subjective foot score profiles. Complications were noted in ten patients in this study.

McBride's soft tissue realignment and Mitchell's osteotomy were retrospectively compared in a review of thirty three cases by Schwitalle *et al.* (1998), who reported that neither procedure was superior to the other in the treatment of HAVB.

It is apparent that as yet no single technique or definitive treatment regime has been proven to be effective in the management of painful HAVB.

2.10 STRAIN COUNTERSTRAIN MOBILIZATION

Jones (1992) defines strain counterstrain mobilization as “relieving spinal or other joint pain by passively putting the joint into its position of greatest comfort.” According to Jones (1992) a dysfunctional joint (as in HAVB) treated by positioning for comfort using the strain counterstrain mobilization, will be identical with that of the original strain affecting that joint. This position shortens the muscle containing the dysfunctioning proprioceptors (which provide information on the positional state of the joints). Jones (1992) maintains that this position of comfort allows the primary and secondary proprioceptive nerve endings to cease their abnormal activity thus correcting the joint dysfunction. Despite the lack of empirical evidence, Jones (1992) and D`Ambrogio and Roth (1997) claim that this technique has the following benefits:

- normalization of muscle hyper tonicity and fascial tension
- reduction of joint hypomobility
- increased circulation and reduced swelling
- decreased pain
- increased strength.

Regardless of the authors many years of practical experience in this technique, the lack of scientific data to substantiate the validity of these proposed benefits

nullifies any reliability associated with their claims.

Jones (1992) claims that this technique is an effective, passive, non-thrust mobilization for the relief of HAVB pain which can be performed without trauma.

This may be particularly beneficial for the patient when comparing this mobilization to the high velocity chiropractic thrust which can on occasion lead to an increased level of pain in the adjusted bunion, according to Brantingham (personal communication, 1999). Although specific reasons responsible for this increase in bunion pain were not offered, it may be possible that a high velocity thrust will result in aggravation of the inflammatory process already occurring in the first MTP joint as well as leading to a painful muscle spasm in the associated musculature.

After analysis of the current literature, it appears that no studies of strain counterstrain mobilization for the treatment of HAVB have been conducted. In fact, only very few studies involving osteopathic manipulative techniques or OMT (which include strain counterstrain mobilization techniques) have ever been carried out (Radjeski *et al.*, 1998). It should be noted that even though all of these existing studies are poorly designed, they have all utilized strain counterstrain mobilization in addition to other osteopathic techniques.

According to Radjieski *et al.* (1998), most of the research has been uncontrolled case studies, unpublished studies or studies published in journals not commonly included in the data base of resources used in standard medical literature searches.

In a small study involving fourteen patients with pancreatitis, Radjieski *et al.* (1998) found that patients who received ten to twenty minutes daily OMT using myofascial release, soft tissue and strain counterstrain techniques, in addition to standard care during the course of their hospital stay, had on average, a significantly shorter length of stay (mean reduction of 3.5 days) than the control patients who received only standard medical care. The standard medical care consisted of intravenous hydration, administration of analgesics and elimination of oral intake of fluids and food. Although the researchers can find no clear mechanism by which OMT decreased the hospital length of stay, it may be possible that the personal care and attention given during OMT to the treatment group patients (who all had a history of alcohol or polysubstance abuse) could have been responsible for the difference.

Five patients suffering with cervicothoracic pain were treated with OMT in addition to receiving analgesic medication in a pilot study conducted by Walko

and Janouschek (1994). The OMT consisted of high-velocity, low-amplitude thrust techniques and non-thrust techniques including; soft tissue muscle stretching, myofascial release, strain counterstrain and joint mobilization techniques.

Results demonstrated that the pain scale score improved an average of almost thirty percent while the mean temperature of the cervicothoracic regions measured thermographically, decreased an average of 0.98 degrees centigrade in all the patients. The validity of this study can be questioned as the researchers attribute the patient's improvement exclusively to the OMT but make no mention of the possible benefits of the analgesic medication.

In a another pilot study involving twelve patients, Hoffman and Hoffman (1994) examined the effect of OMT, nonsteroidal anti-inflammatory drugs and heel lifts on chronic low back pain. The OMT included muscle energy techniques and strain counterstrain mobilization while the rubber heel lifts worn inside the shoe, were placed on the side of sacral base declination i.e. the short leg side. Results showed statistically significant relief from low back pain leading researchers to implicate OMT as an effective therapy. However, due to the fact that three treatment modalities were used simultaneously, the effectiveness of OMT remains questionable.

It would appear that strain counterstrain techniques may be valuable in the treatment of various disorders, however there is a large void in the literature regarding its application in the treatment of HAVB despite unsubstantiated claims by Jones (1992), that it is a highly effective modality. The results of this study will help to determine the efficacy of this treatment protocol in the management of HAVB.

CHAPTER THREE: MATERIALS AND METHODOLOGY

3.1 STUDY DESIGN AND PROTOCOL

The design was that of a prospective, randomised, placebo controlled study. This study incorporated sixty subjects recruited from the greater Durban area using convenience sampling i.e. advertisements placed around the Technikon Natal campus, at supermarkets, at Ballet and Dance studios and in the local newspapers. It was advertised that free treatment would be administered to the public who were suffering with painful bunions and who were willing to participate in this study. Upon telephonic reply, the potential subjects had the exact study protocol explained to them. Any person between the ages of fifteen and sixty five, literate and who was not receiving any treatment for his/her painful bunion was scheduled for an initial consultation.

3.1.1 STANDARD OF ACCEPTANCE

At the initial consultation, potential candidates for the study underwent the following process:

- each subject had to undergo a case history (Appendix A)
- each subject had to undergo a physical examination (Appendix B)

- each subject had to undergo a foot regional examination (Appendix C)

These investigations were used to screen the applicants for the respective inclusion and exclusion criteria. When clinically indicated, a radiographic examination of the involved foot was carried out in order to exclude, or assess the relevance of, any other pathologies such as degeneration, inflammation, malformation or mechanical disturbance of the foot that may have been a cause of the bunion pain. In those cases the following views were taken; anteroposterior, lateral and oblique. Following examination, a diagnosis was determined.

3.1.2 INCLUSION CRITERIA

The inclusion criteria were based on a combination of diagnostic criteria as used by Calliet (1997), Levy and Hetherington (1990) and Klenerman (1991).

Subjects had to have the following:

- enlarged medial portion of the first metatarsal head
- pain around the first metatarsophalangeal (MTP) joint
- inability to wear shoes comfortably
- mild, moderate or severe lateral deviation (or abduction) of the hallux from the mid-sagittal plane.

3.1.3 EXCLUSION CRITERIA

Subjects were excluded from the study if they had any known systemic, neurological or connective-tissue disorders (Kilmartin *et al.*,1994). Applicants younger than fifteen years and older than sixty five years were also excluded from the study as the researcher felt that this age range represented that in which most people with HAVB were either devoid of or too far advanced in other pathologies, such as arthritis. In addition to this, any subjects with known contraindications to strain counterstrain mobilization were also excluded from the study. D`Ambrogio and Roth (1997) list the contraindications as follows:

- malignancy
- acute rheumatoid arthritis
- open wounds
- sutures
- healing fractures
- haematoma
- skin hypersensitivity
- systemic/localised infection

Eligible candidates were required to complete an informed consent form (Appendix I). Those subjects who were minors, required signed consent from their parent or legal guardian once the terms and conditions of the study had been explained. All the subjects then had their diagnosed condition briefly explained to them. They were not informed as to whether they were in the control or experimental group as this would influence the results.

The subjects were then randomly assigned into two groups of equal number by drawing a number between one and sixty from a hat. Subjects who drew even numbers were assigned to Group A while those who drew odd numbers were assigned to Group B.

- Group A; experimental group consisting of thirty subjects
- Group B; control group consisting of thirty subjects

Those patients in Group A received strain counterstrain mobilization while those in Group B received placebo laser. Those patients who dropped out of the study were replaced by new patients in the same random process as before.

Single blinding was utilised for this study, with only the researcher being aware of which intervention each patient was receiving.

3.1.4 INTERVENTION

The patients were informed how the treatment modality they were receiving may be effective in the treatment of their painful HAVB. All the patients had the plantar aspect of their feet assessed for trigger points particularly under the lateral sesamoid bone for the bunion trigger point. This trigger point, also known as the bunion tender point, is associated with pain and dysfunction on the medial side of the hallux (Jones, 1992). The presence and location of any such trigger points were recorded. Using the staining characteristics of gentian violet, the exact position of these trigger points were marked so that the same point was used in subsequent consultations.

Patients in Group A received the strain counterstrain mobilization to their big toes as described by Jones (1992). The patients were placed in the prone position with the involved-side knee flexed to ninety degrees. The bunion trigger point on the plantar aspect of the lateral sesamoid was contacted and pressure was applied by the examiner in a plantar to dorsal direction using a thumb contact. Using the other hand, the examiner then contacted the hallux and induced abduction (away from the midline), eversion (valgus) and flexion of the first MTP joint. When the patient and examiner were satisfied that the position of greatest comfort had been achieved by a reported level of at least 50 percent relief in the

tender point, then that position was maintained for ninety seconds. At the end of this time period, great care was taken in returning the hallux to its neutral position at a very slow rate, as described by Jones (1992). Since no specific time frame for returning the hallux to the neutral position was stipulated by Jones (1992), the researcher decided on a thirty second period.

Once patients in Group B had the mechanism and benefits of laser therapy explained to them (despite the fact that it was placebo), they were placed in the same prone position as the patients in Group A. While in this position, the examiner applied placebo laser for ninety seconds. The laser was administered by setting the timer at ninety seconds but with the intensity at zero.

Based on observations made by D'Ambrogio and Roth (1997), each patient was treated five times within a three week period as they were of the opinion that if no significant decrease in pain had taken place after three to five treatments, then a cause other than HAVB may be suspected for causing the pain. Therefore in this study, it was decided that five treatments would be sufficient to determine the effect of strain counterstrain mobilization on HAVB.

All patients were instructed to continue with their normal individual activities as changing these would have decreased the accuracy of the results. They were however advised against the use of tight, narrow, pointed or high-heeled shoes

as they are known to aggravate HAVB (Reid, 1995:148).

3.1.5 ETHICAL CONSIDERATIONS

The patients were informed that they could leave the study at any time.

The harmful effects of the radiographic examination for those requiring x-rays was minimal and the patients were informed of them.

The patients were not coerced into participating in the study and they were assured that all patient information would be treated confidentially.

Informed consent was obtained from all the patients prior to the commencement of treatment and relevant information was given to them in a language they understood.

The patients were informed that their participation in the study would involve no financial benefit and it was seen to that the general rights and welfare of the patients were protected.

3.2 MEASUREMENT AND OBSERVATION

3.2.1 THE DATA

This study made use of both primary and secondary data as mentioned below:

3.2.1.1 PRIMARY DATA

- Case history (Appendix A)
- Physical examination (Appendix B)
- Foot regional examination (Appendix C)
- NRS-101 (Appendix D)
- Short-form McGill (Appendix E)
- FFI (Appendix F)
- Algometer readings (Appendix G)

3.2.1.2 SECONDARY DATA

Current literature was obtained from journals, text books, the Internet and Medline which contained information relating to HAVB and its treatment.

3.2.2 METHODS OF MEASUREMENT

3.2.2.1 SUBJECTIVE MEASUREMENT

i) Numerical Pain Rating Scale-101 (NRS-101) (Appendix D)

The patients were required to indicate the maximum and minimum intensities of their pain as they experienced it over the past few days, using a number between zero and one hundred. This questionnaire is therefore used in assessing the extremes of pain intensity as well as the average pain intensity for each patient (Govender, 2000). In a study comparing six different methods of determining pain intensity, Jensen *et al.* (1986) evaluated them according to the following criteria:

- ease of administration of scoring
- relative rates of incorrect responding
- sensitivity as defined by statistical power
- the magnitude of the relationship between each scale and the linear combination of the pain indices, and
- sensitivity as defined by the number of available response categories.

Jensen *et al.* (1986) concluded that especially considering the last three criteria, the NRS-101 appeared to be the most practical index.

ii) Short-form McGill Pain Questionnaire (McGill) (Appendix E)

This questionnaire was developed from the McGill Long-form Questionnaire and it contains fifteen descriptors (eleven sensory; four affective) which are rated on an intensity scale as 0=none, 1=mild, 2=moderate or 3=severe (Melzack,1987).

This shortened version of the original was developed for use in studies when time to gather information from the patients was limited (Melzack, 1987). Data obtained from this questionnaire included information on the sensory, affective and overall intensity of pain, thus showing promise as a useful measuring tool (Melzack, 1987).

iii) Foot Function Index (FFI) (Appendix F)

This index was developed to assess the implications of foot pathology on function in terms of pain, disability and activity restriction. The reliability, consistency and validity of the FFI have been studied and shown to be a useful instrument for both clinical and research purposes (Budiman-Mak,1991). In a study by Saag *et al.* (1996), findings further supported the FFI as “an easy-to-use, reliable indicator of arthritis foot pain”, however they indicated that it had not been validated in any other population of patients and was unproven for general use.

3.2.2.2 OBJECTIVE MEASUREMENT

The algometer measurements were used to determine any change in the patients pressure-pain tolerance levels in hypersensitive spots or trigger points, thus reflecting a quantitative response to the treatments (Fischer, 1986).

Fischer (1987) reports that these hypersensitive areas may be due to pain originating from ligaments, joint capsules, tendons and periosteum. In an article by Nussbaum and Downes (1998), they stated that the algometer had the potential to provide information on the daily changes in soft tissue tenderness.

The algometer used in this study was the Push-Pull Force Gage, manufactured by Activator Methods, Inc.: 3714 E Indian School Road, Phoenix, Arizona, 85018 which has a pressure range of eleven kilograms. The algometer readings were taken as follows:

The area of tenderness at the bunion tender point was first located using palpation. Gentian violet was then applied to the skin overlying this area in order to mark the precise location of the trigger point for maximum accuracy in algometer recordings in the remaining consultations. The footplate of the algometer was then placed over this mark so that the pressure exerted was in the same direction which produced pain on palpation. The pressure was increased gradually at a rate of one kilogram per centimetre squared per second

(1kg/cm²/s). The patients were instructed to indicate vocally when they could no longer tolerate the pain. At subsequent consultations, algometer readings were taken from the same marked location. The patients were not made aware of their readings in order to eliminate patient-bias as far as possible.

3.3 LOCATION OF THE DATA

The primary data was obtained from the NRS-101, McGill and FFI questionnaires as well as from the algometer readings. The patients completed the questionnaires prior to the treatments at the first, third and fifth consultations. The algometer readings were taken before and after the treatments at the first, third and fifth consultations. All consultations were conducted at the Technikon Natal, Chiropractic Day Clinic.

The secondary data was obtained from journals, text books, the Internet and Medline. Where literature was not available at the Technikon Natal Library, then inter-library loans were used.

3.4 STATISTICAL ANALYSIS

3.4.1 TREATMENT OF THE CONTINUOUS VARIABLES

Treatment of the algometer readings and Numerical Rating Scale-101 scores were as follows:

- i) the questionnaires were checked by the examiner to ensure that they had all been completed correctly
- ii) the readings obtained from the algometer and NRS-101, were entered into a computer spreadsheet program in their raw form
- iii) the maximum (#1) and minimum (#2) scores on the NRS-101 questionnaires were recorded individually as well as averaged (A_v) by adding them together and then dividing them by two before being recorded separately for Group A and Group B
- iv) the data was then statistically analysed.

Parametric methods namely; the two-sample paired t-test was used for the intra-group data analysis of the continuous variables (the algometer readings and the NRS-101 scores), while the two-sample unpaired t-test was used to statistically analyse the inter-group data of the continuous variables.

3.4.2 TREATMENT OF CATEGORICAL VARIABLES

Treatment of the short-form Mc Gill and Foot Function Index questionnaires were as follows:

- i) the readings obtained from these questionnaires were entered into a computer spreadsheet in their raw form
- ii) readings for each questionnaire were averaged by adding the individual scores together and then dividing them by the total number of questions in each questionnaire
- iii) average scores for Group A and Group B were recorded separately
- iv) the data was then statistically analysed.

A non-parametric test namely; Wilcoxon's sign-rank test was used for the intra-group statistical data analysis of the short-form Mc Gill and Foot Function Index questionnaires as they typify categorical variables. For the inter-group data analysis, another non-parametric test namely; Mann-Whitney unpaired U test was used to analyse these questionnaires.

3.4.3 INTRA-GROUP HYPOTHESIS TESTS

3.4.3.1 CONTINUOUS VARIABLES

The two-sample paired t-test was used to analyse the data obtained from the algometer readings and the NRS-101 scores within each group. The results from each group that were compared were selected from:

- i) initial treatment and third treatment
- ii) initial treatment and fifth treatment
- iii) third treatment and fifth treatment

The comparison of these figures determined the level of significance.

3.4.3.2 CATEGORICAL VARIABLES

The Wilcoxon sign-rank test was used to statistically analyse the short-form McGill and Foot Function Index questionnaire scores from within both groups. The scores for these questionnaires were compared as follows:

- i) initial treatment and third treatment
- ii) initial treatment and fifth treatment
- iii) third treatment and fifth treatment

The level of significance was determined using a comparison of these figures.

3.4.4 INTER-GROUP HYPOTHESIS TESTS

3.4.4.1 CONTINUOUS VARIABLES

The two-sample unpaired t-test was used to analyse the algometer readings and NRS-101 scores between Group A and Group B. The groups were compared as follows:

- i) initial treatment of Group A and Group B
- ii) third treatment of Group A and Group B
- iii) fifth treatment of Group A and Group B

The level of significance was determined using a comparison of these figures.

3.4.4.2 CATEGORICAL VARIABLES

Using the Mann-Whitney unpaired U test, the scores from the short-form McGill and Foot Function Index questionnaires from Group A and Group B were compared according to the following:

- i) initial treatment of Group A and Group B
- ii) third treatment of Group A and Group B
- iii) fifth treatment of Group A and Group B

The examiner completed the statistical analysis of the intra-group and inter-group data with the assistance of the Technikon Natal statistician. All statistical analyses were performed using the SPSS Statistical Package (version 9.0) as supplied by SpSS Inc., Marketing Department, 444 North Michigan Avenue, Chicago, Illinois, 60611.

3.5 ADDRESSING THE SUBPROBLEM

The results obtained from the statistical analysis of the subjective and objective data was then used to address the objectives of the study.

CHAPTER FOUR: THE RESULTS

4.1 INTRODUCTION

This chapter deals with the results accompanied by relevant interpretations obtained after statistically analysing the data from the measurement criteria utilised namely;

- the algometer readings
- the NRS-101 scores
- the short-form Mc Gill scores
- the FFI scores

The results obtained for the intra-group and inter-group data analysis are tabulated below. The tables include the level of significance (P-value), the standard deviation (Sd.), the standard error (Se.) and the mean (Me).

The power analysis was only computed for the intra-group continuous variables namely; the algometer readings and the NRS-101 scores and are tabulated below the appropriate intra- group tables. Results of the Power test determine whether a type II error may have occurred, which will occur five percent of the time at a ninety five percent confidence level. Any result of fifty percent i.e. 0.5 or greater,

is acceptable (Govender personal communication, 2000), but the gold standard for the Power test is usually eighty percent i.e. 0.8. However with small sample sizes, power will be typically poor.

4.2 CRITERIA GOVERNING THE ADMISSIBILITY OF DATA

Only the data collected from patients who met with the criteria of the study was used. Only responses to the NRS-101, McGill and FFI, completed under the researcher's supervision were utilised. Similarly, only the algometric measurements for pressure-pain tolerance taken by the researcher were used.

4.3 THE HYPOTHESIS

The null hypothesis (Ho) is the same for both groups and is described below:

Ho: On analysis of the intra-group data there would be no statistical improvement in the subjective and objective findings, indicating that the treatment was statistically insignificant.

The alternative hypothesis (Ha) is the same for both groups and is described below:

Ha: On analysis of the intra-group data there would be a statistical improvement in the subjective and objective findings, indicating that the treatment was statistically significant.

Integrating the data from the two groups required a further null hypothesis and an alternative hypothesis as described below:

Ho: On analysis of the inter-group data there would be no statistical difference in the subjective and objective findings, indicating that the two treatments were equally effective.

Ha: On analysis of the inter-group data there would be a statistical difference in the subjective and objective findings, indicating that the two treatments were not equally effective.

4.4 THE ANALYSED DATA

4.4.1 P-VALUE

The data was analysed at the $\alpha = 0.05$ level and the decision rule was applied as follows:

- Reject the null hypothesis if the P-value is $\leq \alpha / 2$.
- Accept the null hypothesis if the P-value is $\geq \alpha / 2$, where $\alpha / 2 = 0.025$.

Therefore to conclude that there is a statistically significant improvement at the $\alpha = 0.05$ level, the P-value would have to be ≤ 0.025 .

4.4.2 THE POWER VALUE

The power value determines the sensitivity of the statistical tests by assessing the probability of a particular test to detect a difference between the groups. The power values were calculated using the following UCLA web site;

<http://www.stat.ucla.edu/calculators/powercalc/normal> and then converted to a percentage. The closer the power value is to 100 percent the smaller the probability of accepting a type II error and the greater the sensitivity of the test.

4.5 THE DEMOGRAPHIC DATA

4.5.1 AGE DISTRIBUTION OF PATIENTS

TABLE 4.1 *Age distribution of patients.*

AGE	MOBILIZATION GROUP	PLACEBO GROUP	% OF PATIENTS
15 - 24	6	4	16.67 %
25 - 34	2	1	5.00 %
35 - 44	5	0	8.34 %
45 - 54	8	9	28.34 %
55 - 65	9	16	41.67 %

TABLE 4.2 *Average age and age range of patients.*

AGE	MOBILIZATION GROUP	PLACEBO GROUP
AVERAGE AGE	44.7 years	51.3 years
AGE RANGE	21 - 64 years	15 - 65 years

4.5.2 GENDER DISTRIBUTION OF PATIENTS

TABLE 4.3 *Gender distribution of patients.*

GENDER	MOBILIZATION GROUP		PLACEBO GROUP	
	TOTAL NO.	%	TOTAL NO.	%
MALE	7	11.67 %	3	5.00 %
FEMALE	23	38.34 %	27	45.00 %

4.5.3 RACE DISTRIBUTION OF PATIENTS

TABLE 4.4 *Race distribution of patients.*

RACE	MOBILIZATION GROUP		PLACEBO GROUP	
	TOTAL NO.	%	TOTAL NO.	%
WHITE	25	41.67 %	25	41.67 %
BLACK	1	1.67 %	2	3.34 %
INDIAN	2	3.34 %	3	5.00 %
COLOURED (Mixed)	2	3.34 %	0	0.00 %

4.5.4 BUNION DISTRIBUTION OF PATIENTS

TABLE 4.5 *Bunion distribution of patients.*

BUNION	MOBILIZATION GROUP		PLACEBO GROUP	
	TOTAL NO.	%	TOTAL NO.	%
UNILATERAL	7	11.67 %	6	10.00 %
BILATERAL	23	38.34 %	24	40.00 %
FAMILY HISTORY				
◦ YES	24	40.00 %	19	31.67 %
◦ NO	4	6.67 %	4	6.67 %
◦ UNCERTAIN	2	3.34 %	7	11.67 %

4.6 INTRA-GROUP RESULTS

4.6.1 PARAMETRIC TWO-SAMPLE PAIRED T-TEST FOR

ALGOMETER AND NUMERICAL RATING SCALE-101 SCORES

TABLE 4.6 Statistical results of the algometric measurements and Numerical Rating Scale-101 comparing the first and third treatments in the mobilization group.

	TREATMENT 1			P-value	TREATMENT 3		
	Me.	Sd.	Se.		Me.	Sd.	Se.
ALGOMETER	6.43	1.40	0.26	<u>.002</u>	7.19	1.33	0.24
NRS-101#1	66.50	18.67	3.41	<u>.000</u>	39.47	25.15	4.59
NRS-101#2	15.20	16.08	2.94	.917	15.47	16.87	3.08
NRS-101 Av	40.85	12.80	2.34	<u>.000</u>	27.47	19.00	3.47

POWER	
ALGOMETER	100%
NRS-101#1	100%
NRS-101#2	56.4%
NRS-101 Av	100%

The null hypothesis was rejected for the algometric measurements, the maximum (#1) and the average (Av) NRS-101 scores, indicating a significant improvement between the first and third treatments in the mobilization group.

However the null hypothesis was accepted for the minimum (#2) NRS-101 scores, indicating no significant improvement over the same treatment interval.

TABLE 4.7 Statistical results of the algometric measurements and the Numerical Rating Scale-101 comparing the first and fifth treatments in the mobilization group.

	TREATMENT 1			P-value	TREATMENT 5		
	Me.	Sd.	Se.		Me.	Sd.	Se.
ALGOMETER	6.43	1.40	0.26	.000	8.14	1.42	0.26
NRS-101#1	66.50	18.67	3.41	.000	28.10	21.30	3.89
NRS-101#2	15.20	16.08	2.94	.218	11.53	16.73	3.06
NRS-101 Av	40.85	12.80	2.34	.831	19.81	34.52	6.30

POWER	
ALGOMETER	100%
NRS-101#1	100%
NRS-101#2	90.9%
NRS-101 Av	100%

The null hypothesis was rejected for the algometric measurements and for the maximum (#1) NRS-101 scores, indicating a significant improvement between the first and fifth treatments in the mobilization group.

The null hypothesis was however accepted for the minimum (#2) and average (Av) NRS-101 scores thus indicating no significant improvement over the same treatment interval.

TABLE 4.8 Statistical results of the algometric measurements and the Numerical Rating Scale-101 comparing the third and fifth treatments in the mobilization group.

	TREATMENT 3			P-value	TREATMENT 5		
	Me.	Sd.	Se.		Me.	Sd.	Se.
ALGOMETER	7.19	1.33	0.24	<u>.001</u>	8.14	1.42	0.26
NRS-101#1	39.47	25.17	4.59	<u>.000</u>	28.10	21.30	3.89
NRS-101#2	15.47	16.87	3.08	<u>.023</u>	11.53	16.73	3.06
NRS-101 Av	27.47	19.00	3.47	<u>.006</u>	19.81	34.52	6.30

POWER	
ALGOMETER	100%
NRS-101#1	100%
NRS-101#2	93.23%
NRS-101 Av	98.10%

The null hypothesis was rejected for all the readings in the above table, indicating a significant improvement between the third and fifth treatments in the mobilization group for the algometric measurements and the NRS-101 scores.

TABLE 4.9 Statistical results of the algometric measurements and the Numerical Rating Scale-101 comparing the first and third treatments in the placebo group.

	TREATMENT 1			P-value	TREATMENT 3		
	Me.	Sd.	Se.		Me.	Sd.	Se.
ALGOMETER	5.78	1.09	0.20	.057	6.39	1.70	0.31
NRS-101#1	57.33	27.91	5.10	<u>.000</u>	29.03	25.73	4.70
NRS-101#2	10.40	12.90	2.36	.179	6.97	9.85	1.80
NRS-101 Av	33.87	17.97	3.28	<u>.000</u>	18.00	15.16	2.77

POWER	
ALGOMETER	100%
NRS-101#1	100%
NRS-101#2	99.21%
NRS-101 Av	100%

The null hypothesis was rejected for the maximum (#1) and the average (Av) NRS-101 scores, indicating a significant improvement between the first and third treatments in the placebo group whereas the null hypothesis for the algometric measurements and the minimum (#2) NRS-101 scores was accepted, thus showing no significant improvement over the same treatment interval.

TABLE 4.10 Statistical results of the algometric measurements and the Numerical Rating Scale-101 comparing the first and fifth treatments in the placebo group.

	TREATMENT 1			P-value	TREATMENT 5		
	Me.	Sd.	Se.		Me.	Sd.	Se.
ALGOMETER	5.78	1.09	0.20	<u>.000</u>	7.58	1.66	0.30
NRS-101#1	57.33	27.91	5.10	<u>.000</u>	21.10	26.31	4.82
NRS-101#2	10.40	12.91	2.36	.093	5.70	11.98	2.19
NRS-101 Av	33.87	17.97	3.28	.253	13.40	16.62	3.03

POWER	
ALGOMETER	100%
NRS-101#1	100%
NRS-101#2	99.97%
NRS-101 Av	100%

The null hypothesis was rejected for the algometric measurements and the maximum (#1) NRS-101 scores, indicating an improvement from the first to the fifth treatments in the placebo group.

The null hypothesis was however accepted for the minimum (#2) and the average (Av) NRS-101 scores thus indicating that no significant improvement occurred over the same treatment interval.

TABLE 4.11 Statistical results of the algometric measurements and the Numerical Rating Scale-101 comparing the third and fifth treatments in the placebo group.

	TREATMENT 3			P-value	TREATMENT 5		
	Me.	Sd.	Se.		Me.	Sd.	Se.
ALGOMETER	6.39	1.70	0.31	<u>.000</u>	7.58	1.66	0.30
NRS-101#1	29.03	25.73	4.70	<u>.008</u>	21.10	26.39	4.82
NRS-101#2	6.97	9.85	1.80	.564	5.70	11.98	2.19
NRS-101 Av	18.00	15.16	2.77	.060	13.40	16.62	3.03

POWER	
ALGOMETER	100%
NRS-101#1	99.35%
NRS-101#2	39.67%
NRS-101 Av	98.81%

The null hypothesis was rejected for the algometric measurements and the maximum (#1) NRS-101 scores, indicating a significant improvement between the third to the fifth treatments in the placebo group.

The null hypothesis was however accepted for the minimum (#2) and the average (Av) NRS-101 scores thus indicating that no significant improvement occurred over the same treatment interval.

4.6.2 NON-PARAMETRIC WILCOXON SIGN-RANK TEST FOR THE
SHORT-FORM Mc GILL AND FOOT FUNCTION INDEX
QUESTIONNAIRE SCORES

TABLE 4.12 Statistical results of the short-form Mc Gill Pain Questionnaire
and Foot Function Index comparing the first and third treatments
for the mobilization group.

	TREATMENT 1			P-VALUE	TREATMENT 3		
	Me.	Sd.	Se.		Me.	Sd.	Se.
Mc GILL	12.37	8.05	1.47	.000	5.77	5.67	1.04
FFI	51.00	22.47	4.10	.006	34.90	26.21	4.78

The null hypothesis was rejected for the short-form Mc Gill and Foot Function Index questionnaires, indicating a significant improvement between the first and third treatments in the mobilization group.

TABLE 4.13 Statistical results of the short-form Mc Gill Pain Questionnaire and Foot Function Index comparing the first and fifth treatments for the mobilization group.

	TREATMENT 1			P-VALUE	TREATMENT 5		
	Me.	Sd.	Se.		Me.	Sd.	Se.
Mc GILL	12.37	8.05	1.47	<u>.000</u>	4.30	4.89	.89
FFI	51.00	22.47	4.10	<u>.000</u>	28.63	28.09	5.13

The null hypothesis was rejected for both the short-form Mc Gill and Foot Function Index questionnaires, indicating a significant improvement between the first and fifth treatments in the mobilization group.

TABLE 4.14 Statistical results of the short-form Mc Gill Pain Questionnaire and Foot Function Index comparing the third and fifth treatments for the mobilization group.

	TREATMENT 3			P-VALUE	TREATMENT 5		
	Me.	Sd.	Se.		Me.	Sd.	Se.
Mc GILL	5.77	5.67	1.04	.027	4.30	4.89	.89
FFI	34.90	26.21	4.78	.107	28.63	28.09	5.13

The null hypothesis was accepted for both the short-form Mc Gill and Foot Function Index questionnaires, indicating no significant improvement between the third and fifth treatments in the mobilization group.

TABLE 4.15 Statistical results of the short-form Mc Gill Pain Questionnaire and Foot Function Index comparing the first and third treatments for the placebo group.

	TREATMENT 1			P-VALUE	TREATMENT 3		
	Me.	Sd.	Se.		Me.	Sd.	Se.
Mc GILL	11.33	8.04	1.47	<u>.000</u>	5.80	6.21	1.13
FFI	43.93	30.27	5.53	<u>.000</u>	24.37	23.15	4.23

The null hypothesis was rejected for both the short-form Mc Gill and the Foot Function Index questionnaires, indicating a significant improvement between the first and third treatments in the placebo group.

TABLE 4.16 Statistical results of the short-form Mc Gill Pain Questionnaire and Foot Function Index comparing the first and fifth treatments for the placebo group.

	TREATMENT 1			P-VALUE	TREATMENT 5		
	Me.	Sd.	Se.		Me.	Sd.	Se.
Mc GILL	11.33	8.04	1.47	<u>.000</u>	3.17	4.68	.86
FFI	43.93	30.27	5.53	<u>.000</u>	16.27	23.19	4.23

The null hypothesis was rejected for both the short-form Mc Gill and the Foot Function Index questionnaires, indicating a significant improvement between the first and fifth treatments in the placebo group.

TABLE 4.17 Statistical results of the short-form Mc Gill Pain Questionnaire and Foot Function Index comparing the third and fifth treatments for the placebo group.

	TREATMENT 3			P-VALUE	TREATMENT 5		
	Me.	Sd.	Se.		Me.	Sd.	Se.
Mc GILL	17.23	13.72	2.51	<u>.000</u>	3.17	4.68	.86
FFI	24.37	23.15	4.23	<u>.001</u>	16.27	23.19	4.23

The null hypothesis was rejected for both the short-form Mc Gill and the Foot Function Index questionnaires, indicating a significant improvement between the third and fifth treatments in the placebo group.

4.7 INTER-GROUP RESULTS

4.7.1 PARAMETRIC TWO-SAMPLE UNPAIRED T-TESTS FOR ALGOMETRIC MEASUREMENTS AND THE NUMERICAL RATING SCALE-101 SCORES

TABLE 4.18 Statistical results of the algometric measurements and the Numerical Rating Scale-101 comparing first treatments for the mobilization and placebo groups.

	MOBILIZATION GROUP			P-value	PLACEBO GROUP		
	Treatment 1				Treatment 1		
	Me.	Sd.	Se.		Me.	Sd.	Se.
ALGOMETER	6.43	1.40	.26	.050	5.78	1.09	.2
NRS-101#1	66.50	18.67	3.41	.140	57.33	27.91	5.10
NRS-101#2	15.20	16.08	2.94	.207	10.40	12.90	2.36
NRS-101 Av	40.85	12.80	2.34	.088	33.87	17.97	3.28

The null hypothesis was accepted for the above readings, which indicated that there was no significant improvement between the mobilization and placebo groups at the first treatment for the algometric measurements or the NRS-101 scores.

TABLE 4.19 Statistical results of the algometric measurements and the Numerical Rating Scale-101 comparing third treatments for the mobilization and placebo groups.

	MOBILIZATION GROUP			P-value	PLACEBO GROUP		
	Treatment 3				Treatment 3		
	Me.	Sd.	Se.		Me.	Sd.	Se.
ALGOMETER	7.19	1.33	.24	.046	6.39	1.70	.31
NRS-101#1	39.47	25.15	4.59	.118	29.03	25.73	4.70
NRS-101#2	15.47	16.87	3.08	<u>.020</u>	6.97	9.85	1.80
NRS-101 Av	27.47	19.00	3.47	.037	18.00	15.16	2.77

The null hypothesis was rejected for the minimum (#2) NRS-101 scores, indicating a significant improvement between the mobilization and placebo groups at the third treatment but it was accepted for all the remaining readings in the above table, indicating no significant improvement over the same treatment period.

TABLE 4.20 Statistical results of the algometric measurements and the Numerical Rating Scale-101 comparing fifth treatments for the mobilization and placebo groups.

	MOBILIZATION GROUP			P-value	PLACEBO GROUP		
	Treatment 5				Treatment 5		
	Me.	Sd.	Se.		Me.	Sd.	Se.
ALGOMETER	8.14	1.42	.26	.168	7.58	1.66	.30
NRS-101#1	28.10	21.30	3.89	.263	21.10	26.39	4.82
NRS-101#2	11.53	16.73	3.06	.126	5.70	11.98	2.19
NRS-101 Av	19.81	34.52	6.30	.148	13.40	16.62	3.03

The null hypothesis was accepted for all the readings in the above table, indicating that no significant improvement took place between the mobilization and placebo groups at the fifth treatment for the algometric measurements or the NRS-101 scores.

4.7.2 NON-PARAMETRIC MANN-WHITNEY UNPAIRED U TEST FOR THE SHORT-FORM Mc GILL AND FOOT FUNCTION INDEX QUESTIONNAIRES

TABLE 4.21 Statistical results of the short-form Mc Gill Pain Questionnaire
and Foot Function Index comparing the first treatments for the
mobilization and placebo groups.

	MOBILIZATION GROUP			P-VALUE	PLACEBO GROUP		
	Treatment 1				Treatment 1		
	Me.	Sd.	Se.		Me.	Sd.	Se.
Mc GILL	12.37	8.05	1.47	.564	11.33	8.04	1.47
FFI	51.00	22.47	4.10	.217	43.93	30.27	5.53

The null hypothesis was accepted for the readings in the above table, indicating that there was no significant improvement between the mobilization and placebo groups at the first treatment for the short-form Mc Gill and Foot Function Index questionnaires.

TABLE 4.22 Statistical results of the short-form Mc Gill Pain Questionnaire and Foot Function Index comparing the third treatments for the mobilization and placebo groups.

	MOBILIZATION GROUP			P-VALUE	PLACEBO GROUP		
	Treatment 3				Treatment 3		
	Me.	Sd.	Se.		Me.	Sd.	Se.
Mc GILL	5.77	5.67	1.03	.959	5.90	6.54	1.19
FFI	34.90	26.21	4.78	.080	24.37	23.15	4.23

The null hypothesis was accepted for the readings in the above tables, indicating that there was no significant improvement between the mobilization and placebo groups at the third treatment for the short-form Mc Gill and Foot Function Index questionnaires.

TABLE 4.23 Statistical results of the short-form Mc Gill Pain Questionnaire and Foot Function Index comparing the fifth treatments for the mobilization and placebo groups.

	MOBILIZATION GROUP			P- VALUE	PLACEBO GROUP		
	Treatment 5				Treatment 5		
	Me.	Sd.	Se.		Me.	Sd.	Se.
Mc GILL	4.30	4.89	.89	.065	3.17	4.68	.86
FFI	28.63	28.09	5.13	.036	16.27	23.19	4.23

The null hypothesis was accepted for the readings in the above table, indicating that there was no significant improvement between the mobilization and placebo groups at the fifth treatment for the short-form Mc Gill and Foot Function Index questionnaires.

4.8 MEAN VALUES REPRESENTED GRAPHICALLY

FIGURE 4.1 *Mean values of the algometric measurements at the first, third and fifth treatments comparing mobilization and placebo groups.*

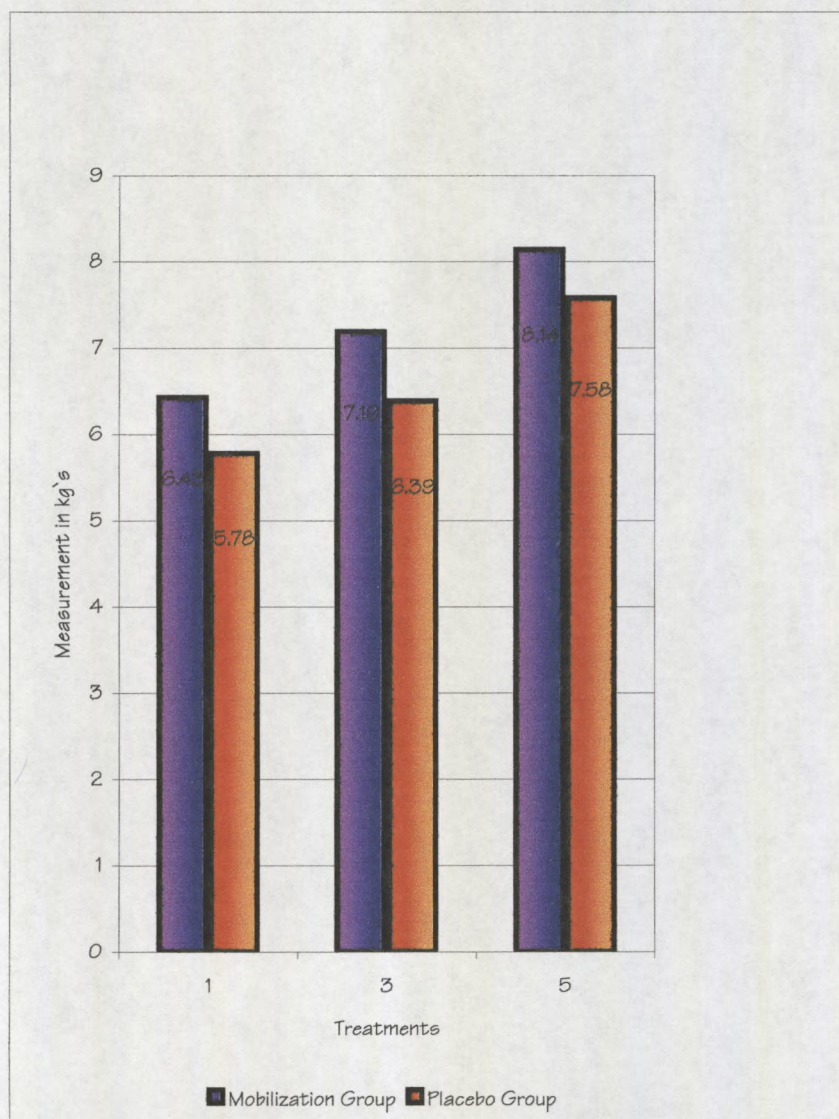


FIGURE 4.2 Mean values of the average Numerical Rating Scale-101 Pain

Questionnaire scores at the first, third and fifth treatments

comparing the mobilization and placebo groups.

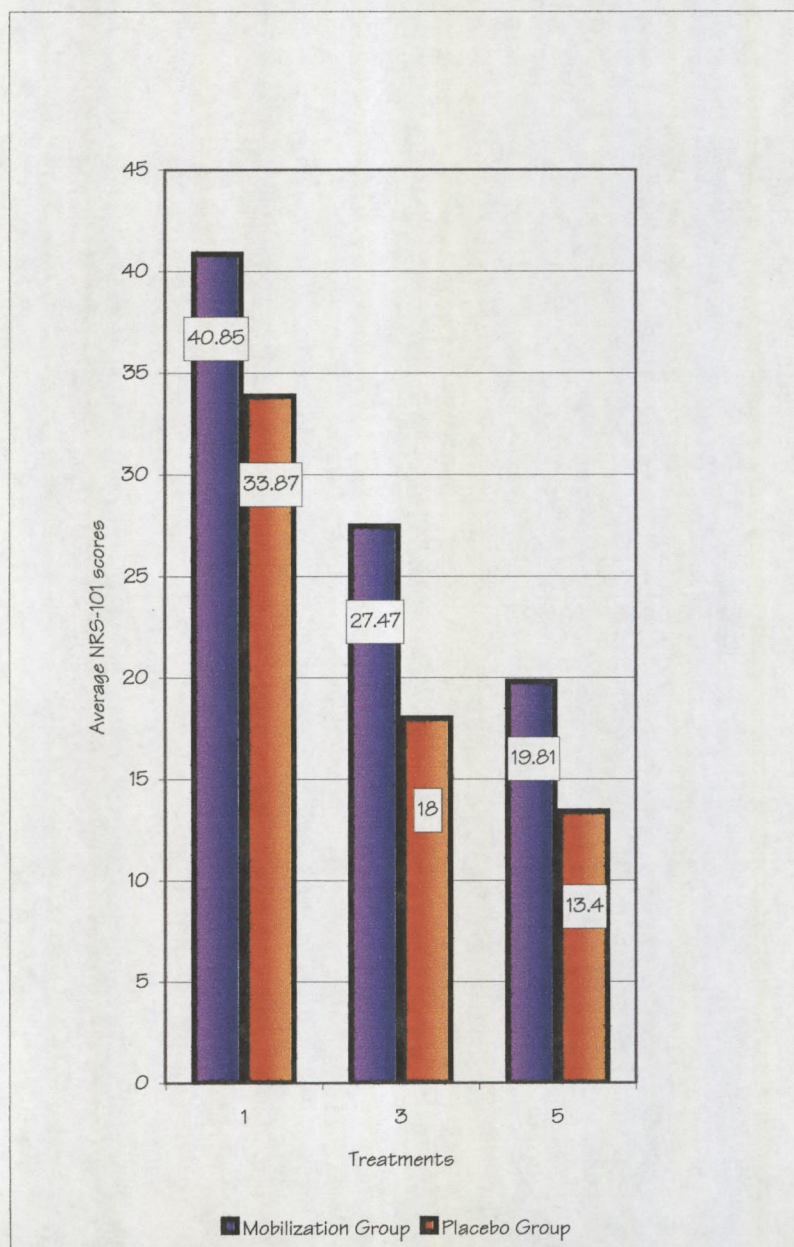


FIGURE 4.3 Mean values of the short-form Mc Gill Pain Questionnaire at the first, third and fifth treatments comparing the mobilization and placebo groups.

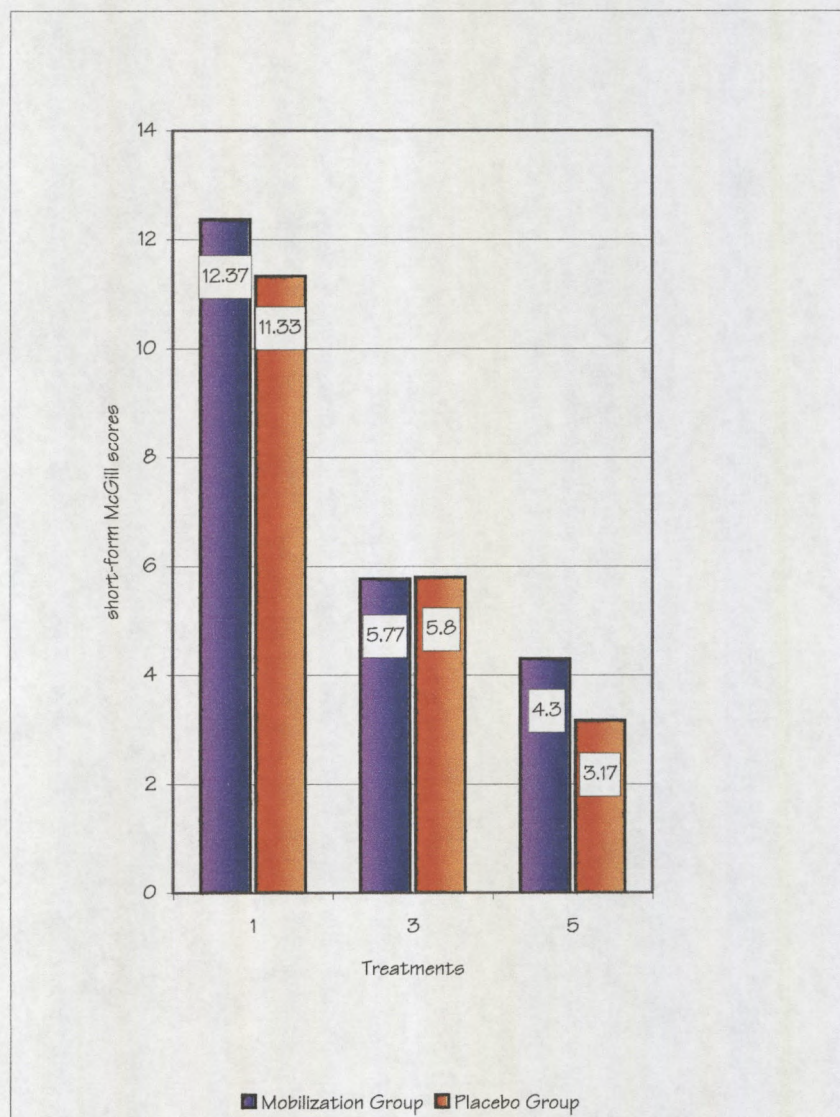
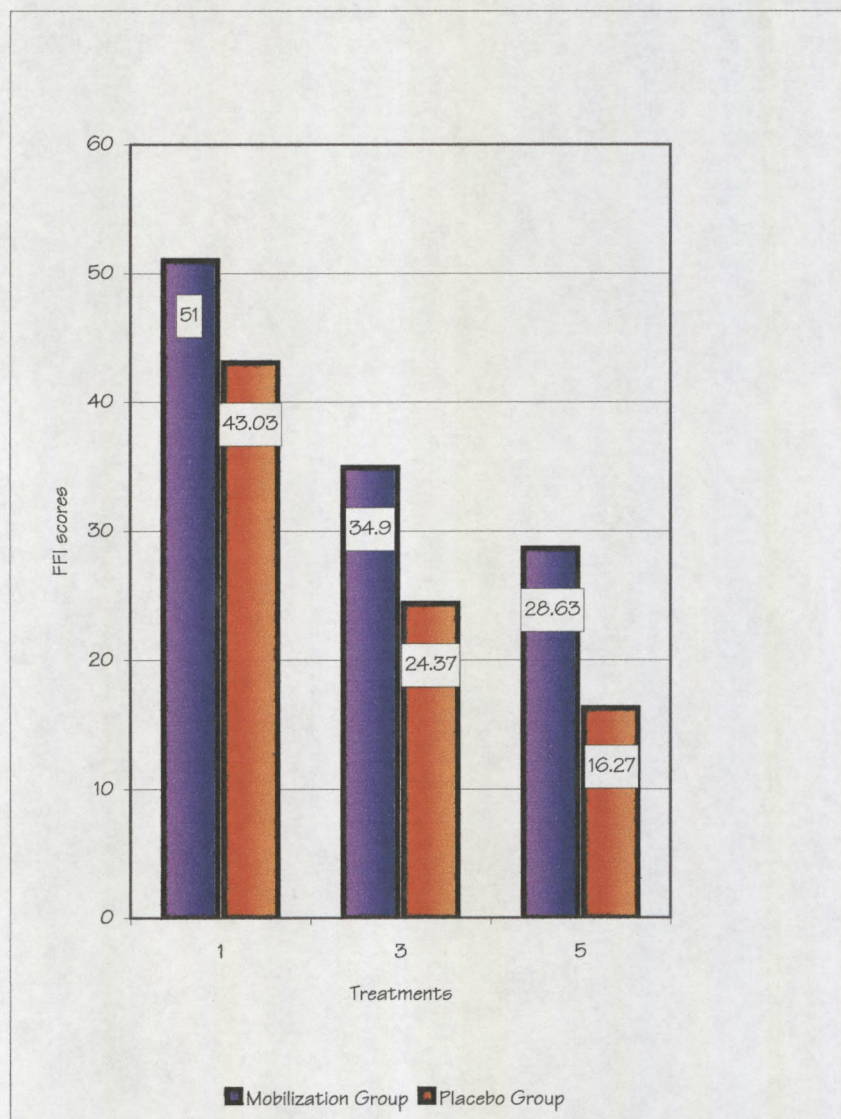


FIGURE 4.4 Mean values of the Foot Function Index at the first, third and fifth treatments comparing the mobilization and placebo groups.



CHAPTER FIVE: DISCUSSION

5.1 INTRODUCTION

This chapter involves the discussion of the results after statistical analysis of the data obtained from the algometer readings, the Numerical Rating Scale-101, the short-form Mc Gill Pain Questionnaire and the Foot Function Index.

The results are discussed in two parts, namely; objective and subjective results. Each measurement parameter is discussed with respect to the intra-group and inter-group data.

The evaluation of the intra-group results of the first and fifth treatments (overall treatment interval) gives an indication of the efficacy of the treatment regime. The comparison of the first and third treatments (first treatment interval), and the third and fifth treatments (second treatment interval) are evaluated in order to determine any residual benefits of the treatment program.

The evaluation of the inter-group results of the first treatment of the mobilization and placebo groups, identifies any differences in the subjective and objective findings at the beginning of the study. Comparison of the inter-group

results of the third treatment of both groups, illustrates any difference in the rate of improvement between the mobilization and placebo groups, while the fifth treatment comparison indicates the effectiveness of the treatment at the conclusion of the study.

5.2 OBJECTIVE DATA

5.2.1 INTRA-GROUP COMPARISON

5.2.1.1 TWO-SAMPLE PAIRED T-TEST

Upon evaluation of the first, second and overall treatment intervals, there was a significant improvement in the mobilization group with respect to the algometer readings (tables 4.6, 4.7 and 4.8). A significant improvement was also demonstrated in the second and overall treatment intervals in the placebo group (tables 4.10 and 4.11), while the first treatment interval in the placebo group had no significant improvement for the algometer readings (table 4.9). These findings suggest that the mobilization and placebo treatments were effective overall in terms of increasing the pressure-pain tolerance levels, however the results indicate that the placebo treatment is less effective than the mobilization treatment in the early treatment stage. These findings support hypothesis one and two, in terms of pressure-pain tolerance.

5.2.2 INTER-GROUP COMPARISON

5.2.2.1 TWO-SAMPLE UNPAIRED T-TEST

Statistical comparison of the first, third and fifth treatments of the mobilization and placebo groups illustrated no significant improvement in the algometer readings (tables 4.18, 4.19 and 4.20). It is however noted that although comparison of the first and third treatments reveals no significant difference, reasonable improvement in both first and third treatments is nevertheless demonstrated. As these improvements are not statistically significant they do not support hypothesis one or two.

5.3 SUBJECTIVE DATA

5.3.1 PAIN PERCEPTION (NRS-101)

5.3.1.1 INTRA-GROUP COMPARISON

5.3.1.1.1 TWO-SAMPLE PAIRED T-TEST

Significant differences were noted for the first and second treatments intervals within the mobilization group in terms the average NRS-101 scores (tables 4.6 and 4.8), while the overall treatment interval showed no significant improvement (table 4.7). While the first treatment interval of the placebo group

demonstrated a significant improvement (table 4.9), the second and overall treatment intervals showed no significant difference for the average NRS-101 scores (tables 4.10 and 4.11). These findings suggest that overall, the mobilization group was effective in terms of decreasing pain perception, as measured by the Numerical Rating Scale-101 (Appendix D), thus supporting hypothesis one and two, in terms of pain perception.

5.3.1.2 INTER-GROUP COMPARISON

5.3.1.2.1 TWO-SAMPLE UNPAIRED T-TEST

No significant difference was noted in the average NRS-101 scores between the mobilization and placebo groups at the first, third and fifth treatments, thus suggesting similarity between the two groups in terms of pain perception as evaluated by the Numerical Rating Scale-101 (tables 4.18, 4.19 and 4.20). There was however a significant difference noted between the mobilization and placebo groups in the third treatment with respect to the minimum (#2) NRS-101 scores (table 4.19), but this result is of little consequence overall. These findings do not support hypothesis one or two.

5.3.2 PAIN PERCEPTION (Mc GILL)

5.3.2.1 INTRA-GROUP COMPARISON

5.3.2.1.1 WILCOXON SIGN-RANK TEST

No significant difference was noted for the second treatment interval in the mobilization group, in terms of pain perception (Mc Gill) (table 4.14). There were however significant differences demonstrated in all treatment intervals in the placebo group (tables 4.15, 4.16 and 4.17) as well as in the first and overall treatment intervals for the mobilization group (tables 4.12 and 4.13). These findings suggest that overall, both groups were effective in terms of decreasing pain perception (Mc Gill), however the placebo group was effective in decreasing pain perception (Mc Gill) between the third and fifth treatments. This supports hypothesis one but not hypothesis two.

5.3.2.2 INTER-GROUP COMPARISON

5.3.2.2.1 MANN-WHITNEY UNPAIRED U TEST

Evaluation of the results showed no significant differences between the mobilization and placebo groups at the first, third and fifth treatments (tables 4.21, 4.22 and 4.23), in terms of pain perception as measured by the short-form

Mc Gill Pain Questionnaire (Appendix E). These findings suggest a similarity between the groups, which furthermore do not support hypothesis one or two.

5.3.3 DISABILITY AND PAIN (FFI)

5.3.3.1 INTRA-GROUP COMPARISON

5.3.3.1.1 WILCOXON SIGN-RANK TEST

Significant differences were noted for the first and overall treatment intervals for the mobilization group (tables 4.12 and 4.13). No significant difference was found in the second treatment interval for the mobilization group (table 4.14). There were however significant differences found in all the treatment intervals within the placebo group, in terms of foot pain and disability (tables 4.15, 4.16 and 4.17). These findings suggest that the mobilization and placebo treatments were effective in reducing foot disability and pain, but the placebo treatment was effective in reducing foot pain and disability in the second treatment interval. This evidence supports hypothesis one but not hypothesis two.

5.3.3.2 INTER-GROUP COMPARISON

5.3.3.2.1 MANN-WHITNEY UNPAIRED U TEST

Upon evaluation of the results, no significant differences were found between the mobilization and placebo groups at the first, third or fifth treatments (tables 4.21, 4.22 and 4.23). This suggests a similarity between the groups, in terms of foot pain and disability as measured by the Foot Function Index (Appendix F).

This information does not support hypothesis one or two.

5.4 INTERPRETATION OF THE CLINICAL FINDINGS

In terms of the subjective and objective clinical findings:

Firstly, it was hypothesised that strain counterstrain mobilization of the hallux would be effective in decreasing the pain in patients with painful HAVB.

It was shown that although the mobilization and placebo treatments were both effective in decreasing the pain associated with HAVB, the mobilization treatment was more effective in the first treatment interval according to the algometric measurements. Interpretation of the NRS-101 scores also showed

that the mobilization treatment was effective in decreasing pain perception, particularly over the first and second treatment intervals, thus supporting the abovementioned hypothesis. The decrease in pain in this study is in general agreement with Walko and Janouschek (1994), who reported an almost thirty percent improvement in pain scores, as well as with Hoffman and Hoffman (1994), who also reported statistically significant pain relief in all twelve patients with low back pain.

Secondly, it was hypothesised that strain counterstrain mobilization of the hallux would be more effective than the placebo treatment in the management of patients with painful HAVB.

Although evaluation of the results showed that both mobilization and placebo treatments were effective in reducing both pain perception (McGill) as well as foot pain and disability (FFI), the placebo treatment was found to be more effective in the later stages of treatment, namely; the second treatment interval. These results do not support the second hypothesis.

5.5 POWER VALUES

Power values were calculated for the intra-group continuous variables, namely; the algometer readings and the NRS-101 scores. It was assumed for this study that there was a greater chance of accepting a type II error when the power analysis was less than fifty percent (Govender personal communication, 2000).

The power values were all acceptable i.e. greater than fifty percent, except for the minimum (#2) NRS-101 scores comparing the third and fifth treatments in the placebo group, where the power was calculated at 39.67 percent.

5.6 PROBLEMS ENCOUNTERED WITH THE DATA

5.6.1 THE OBJECTIVE DATA

Three problems encountered by the examiner with the use of the algometer as an objective tool were:

i) Although the use of palpation and the staining characteristics of gentian violet were used to ensure that the same trigger point was used to take the algometer readings, changes in direction of pressure applied through the shaft of the algometer, skin slack, movement, environmental conditions such as excessive heat or cold, and emotional state of the patient can effect the

readings.

ii) Some patients felt that the pressure required to measure the pressure-pain tolerance reading, left their bunion trigger point feeling bruised and painful for a few days. These patients possibly responded to lower pressure in subsequent treatments in order to prevent further pain.

iii) Although the study protocol called for two algometer measurements of the bunion trigger point, namely; one before treatment and one after treatment, the examiner only discovered during the course of the study that the patients in the mobilization group were placed at a disadvantage as the bunion trigger point was contacted with firm pressure for the duration of the treatment. This resulted in an increase in tenderness in the bunion trigger point in the mobilization group prior to any pressure being applied by the algometer after treatment. This too could have resulted in the mobilization patients responding to a lower pressure to prevent further pain.

5.6.2 THE SUBJECTIVE DATA

In utilising questionnaires, one has to consider the probability of type I and type II errors occurring. Type I errors occur when the patients answer the questionnaires based on what they recall filling in on previous questionnaires,

while type II errors are calculation errors with regards to the questionnaire results. The examiner felt that some of the patients were eager to please the examiner by recording an improvement in subjective scores, despite requests from the examiner to the contrary.

The examiner was also of the opinion that the FFI was not specific enough in its need to classify the extent of pain and disability of the bunion deformity. This fact is confirmed by Saag *et al.* (1996), who maintain that although this questionnaire shows validity in measuring arthritic pain, its use for other foot conditions has not been proven.

CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

This study consisted of sixty patients diagnosed with painful Hallux Abducto Valgus Bunions (HAVB), all of which underwent a medical history, a physical examination and a regional foot examination. The patients were randomly allocated into a mobilization group and placebo group. The former received a treatment of strain counterstrain mobilization to their symptomatic hallux and the latter received a placebo treatment consisting of laser therapy with the output set at zero joules. Each patient received five treatments within a three week period.

The results indicated that both the mobilization and placebo treatments were effective in increasing pressure-pain tolerance (algometer readings), but the mobilization treatment was more effective in the early stages of treatment. In addition to this, results also demonstrated that the mobilization treatment was effective in decreasing pain perception (NRS-101). Furthermore, it was illustrated that although both treatments were effective in decreasing pain perception (McGill) and foot pain and disability (FFI), the placebo treatment was more effective in the later stages of treatment.

These results thus implicate strain counterstrain mobilization as an effective short term treatment for painful HAVB.

Therefore, this study supports the use of strain counterstrain mobilization of the hallux in the treatment of painful HAVB, albeit for the short term relief of pain.

6.2 RECOMMENDATIONS

The researcher recommends the following for future studies:

The inclusion of radiographic examination techniques of all the involved feet so that an unbiased colleague may use specific radiographic angles, namely; the Hallux Abductus angle (Donatelli, 1990) and the Hallux Interphalangeal angle (Donatelli, 1990), to more accurately diagnose the HAVB deformity as defined by the current literature.

The use of an unbiased colleague to record the subjective and objective data, to provide more reliable, unbiased data and thus increase the credibility of the study.

The inclusion of a follow-up consultation, a few weeks after the completion of the study, in order to assess the long term effect of the treatments.

Patients were recruited into this study based on advertisements around the greater Durban area, therefore only those patients with a high degree of interest and time to volunteer were able to participate in this study. Future studies should attempt to determine how results differ from those patients recruited from private practices.

An unbiased colleague, experienced in strain counterstrain techniques, should administer the treatments to ensure greater accuracy in future studies.

The combination of strain counterstrain mobilization with other conservative therapies used in the treatment of HAVB, such as night splints, manipulation (including and excluding the first MTP joint), mobilization and avoidance of high-heeled shoes.

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TECHNIKON NATAL CHIROPRACTIC DAY CLINIC
CASE HISTORY

Patient: _____ Date: _____
file #: _____ X-Ray#: _____
Age: _____ Sex: _____ Occupation: _____
Intern: _____ Signature: _____

FOR CLINICIAN'S USE ONLY

Initial visit clinician: _____ Signature: _____

Case History:

Examination:

Previous:

Current:

X-Ray Studies:

Previous:

Current:

Clinical Path. lab:

Previous:

Current:

Case Status:

PTT:

Conditional:

Signed Off:

Final Sign out:

Recommendations:

Intern's Case History

1. Source of History:
2. Chief Complaint: (patient's own words)

3. Present Illness:

- ▷ Location
- ▷ Onset
- ▷ Duration
- ▷ Frequency
- ▷ Pain (Character)
- ▷ Progression
- ▷ Aggravating Factors
- ▷ Relieving Factors
- ▷ Associated S & S
- ▷ Previous Occurrences
- ▷ Past Treatment and Outcome

4. Other Complaints:

5. Past Medical History:

- ▷ General Health Status
- ▷ Childhood Illnesses
- ▷ Adult Illnesses
- ▷ Psychiatric Illnesses
- ▷ Accidents/Injuries
- ▷ Surgery
- ▷ Hospitalizations

6. Current health status and life-style:

- ▶ Allergies
- ▶ Immunizations
- ▶ Screening Tests
- ▶ Environmental Hazards (Home, School, Work)
- ▶ Safety Measures (seat belts, condoms)
- ▶ Exercise and Leisure
- ▶ Sleep Patterns
- ▶ Diet
- ▶ Current Medication
- ▶ Tobacco
- ▶ Alcohol
- ▶ Social Drugs

7. Immediate Family Medical History:

- ▶ Age
- ▶ Health
- ▶ Cause of Death
- ▶ DM
- ▶ Heart Disease
- ▶ TB
- ▶ Stroke
- ▶ Kidney Disease
- ▶ CA
- ▶ Arthritis
- ▶ Anaemia
- ▶ Headaches
- ▶ Thyroid Disease
- ▶ Epilepsy
- ▶ Mental Illness
- ▶ Alcoholism
- ▶ Drug Addiction
- ▶ Other

8. Psychosocial history:
- ▷ Home Situation and daily life
 - ▷ Important experiences
 - ▷ Religious Beliefs

9. Review of Systems:

- ▷ General
- ▷ Skin
- ▷ Head
- ▷ Eyes
- ▷ Ears
- ▷ Nose/Sinuses
- ▷ Mouth/Throat
- ▷ Neck
- ▷ Breasts
- ▷ Respiratory
- ▷ Cardiac
- ▷ Gastro-intestinal
- ▷ Urinary
- ▷ Genital
- ▷ Vascular
- ▷ Musculoskeletal
- ▷ Neurologic
- ▷ Haematologic
- ▷ Endocrine
- ▷ Psychiatric

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC

PHYSICAL EXAMINATION

Patient: _____ File#: _____ Date: _____
Clinician: _____ Signature: _____
Intern: _____ Signature: _____

1. VITALS

Pulse rate:
Respiratory rate:
Blood pressure: R L
Temperature:
Height:
Weight:

2. GENERAL EXAMINATION

General Impression:
Skin:
Jaundice:
Pallor:
Clubbing:
Cyanosis (Central/Peripheral):
Oedema:
Lymph nodes - Head and neck:
 - Axillary:
 - Epitrochlear:
 - Inguinal:
Urinalysis:

3. CARDIOVASCULAR EXAMINATION

- 1) Is this patient in Cardiac Failure ?
- 2) Does this patient have signs of Infective Endocarditis ?
- 3) Does this patient have Rheumatic Heart Disease ?

Inspection - Scars
 - Chest deformity:
 - Precordial bulge:
 - Neck -JVP:

Palpation: - Apex Beat (character + location):
 - Right or left ventricular heave:
 - Epigastric Pulsations:
 - Palpable P2:
 - Palpable A2:

- Masses (intra- or extramural)
- Aorta:

Percussion - Rebound tenderness:
 - Ascites:
 - Masses:

Auscultation - Bowel sounds:
 - Arteries (aortic, renal, iliac, femoral, hepatic)

Rectal Examination - Perianal skin:
 - Sphincter tone & S4 Dermatome:
 - Obvious masses:
 - Prostate:
 - Appendix:

6. G.U.T EXAMINATION

External genitalia:
 Hemias:
 Masses:
 Discharges:

7. NEUROLOGICAL EXAMINATION

Gait and Posture - Abnormalities in gait:
 - Walking on heels (L4-L5):
 - Walking on toes (S1-S2):
 - Rombergs test (Pronator Drift):

Higher Mental Function - Information and Vocabulary:
 - Calculating ability:
 - Abstract Thinking:

G.C.S.: - Eyes:
 - Motor:
 - Verbal:

Evidence of head trauma:

Evidence of Meningism: - Neck mobility and Brudzinski's sign:
 - Kernigs sign:

Cranial Nerves:

I Any loss of smell/taste:
 Nose examination:

II External examination of eye: - Visual Acuity:
 - Visual fields by confrontation:

- Pupillary light reflexes = Direct:
= Consensual:
- Fundoscopy findings:
- III Ocular Muscles:
Eye opening strength:
- IV Inferior and Medial movement of eye:
- V
 - a. Sensory - Ophthalmic:
- Maxillary:
- Mandibular:
 - b. Motor - Masseter:
- Jaw lateral movement:
 - c. Reflexes - Corneal reflex
- Jaw jerk
- VI Lateral movement of eyes
- VII
 - a. Motor - Raise eyebrows:
- Frown:
- Close eyes against resistance:
- Show teeth:
- Blow out cheeks:
 - b. Taste - Anterior two-thirds of tongue:
- VIII General Hearing:
Rinnes = L: R:
Webers lateralisation:
Vestibular function - Nystagmus:
- Rombergs:
- Wallenbergs:
Otoscope examination:
- IX & Gag reflex:
- X Uvula deviation:
Speech quality:
- XI Shoulder lift:
S.C.M. strength:
- XII Inspection of tongue (deviation):

Motor System:

- a. Power
 - Shoulder = Abduction & Adduction:
= Flexion & Extension:
 - Elbow = Flexion & Extension:
 - Wrist = Flexion & Extension:

- Forearm = Supination & Pronation:
- Fingers = Extension (Interphalangeals & M.C.P's):
- Thumb = Opposition:
- Hip = Flexion & Extension:
= Adduction & Abduction:
- Knee = Flexion & Extension:
- Foot = Dorsiflexion & Plantar flexion:
= Inversion & Eversion:
= Toe (Plantarflexion & Dorsiflexion):

- b. Tone
 - Shoulder:
 - Elbow:
 - Wrist:
 - Lower limb - Int. & Ext. rotation:
 - Knee clonus:
 - ankle clonus:

- c. Reflexes
 - Biceps:
 - Triceps:
 - Supinator:
 - Knee:
 - Ankle:
 - Abdominal:
 - Plantar:

Sensory System:

- a. Dermatomes
 - Light touch:
 - Crude touch:
 - Pain:
 - Temperature:
 - Two point discrimination:

- b. Joint position sense
 - Finger:
 - Toe:

- c. Vibration:
 - Big toe:
 - Tibial tuberosity:
 - ASIS:
 - Interphalangeal Joint:
 - Sternum:

Cerebellar function:

- Obvious signs of cerebellar dysfunction:
- = Intention Tremor:
 - = Nystagmus:
 - = Truncal Ataxia:

Finger-nose test (Dysmetria):

Rapid alternating movements (Dysdiadochokinesia):

Heel-shin test:

Heel-toe gait:

Reflexes:

Signs of Parkinsons:

8. SPINAL EXAMINATION:(See Regional examination)

Obvious Abnormalities:

Spinous Percussion:

R.O.M:

Other:

9. BREAST EXAMINATION:

Summon female chaperon.

Inspection - Hands rested in lap:
- Hands pressed on hips:
- Arms above head:
- Leaning forward:

Palpation - masses:
- tenderness:
- axillary tail:
- nipple:
- regional lymph nodes:

Foot and ankle regional examination

Patient: _____ File no: _____ Date: _____
 Intern: _____ signature: _____
 Clinician: _____ signature: _____

Observation

Gait analysis (antalgic limp, toe off, arch, foot alignment, tibial alignment).

Swelling _____
 Heloma dura _____
 Skin _____
 Nails _____
 Shoes _____

Active movements

<i>weight bearing:</i>	<i>Non weight bearing:</i>
Plantar flexion _____	50° _____
Dorsiflexion _____	20° _____
Supination _____	
Pronation _____	
Toe dorsiflexion _____	40° (mtp) _____
Toe plantar flexion _____	40° (mtp) _____
	Big toe dorsiflexion (mtp) (65-70°) _____
	Big toe plantar flexion (mtp) 45° _____
	Toe abduction + adduction _____
	5° first ray dorsiflexion _____
	5° first ray plantar flexion _____

Resisted Isometric movements:

Knee flexion _____
 Plantar flexion _____
 Dorsiflexion _____
 Supination (inversion) _____
 Pronation (eversion) _____
 Toe extension (dorsiflexion) _____
 Toe flexion (plantar flexion) _____

Passive movement motion palpation

(Passive ROM quality, ROM overpressure, joint play)

Ankle joint: *Plantarflexion* _____ *Dorsiflexion* _____
 Talocrural: *Long axis distraction* _____
 Subtalar joint: *Varus* _____ *Valgus* _____
 First ray: *Dorsiflexion* _____ *Plantarflexion* _____

Circumduction of forefoot on fixed rearfoot: _____
Midtarsal: A-P glide _____ P-A glide _____ rotation _____
Tarsometatarsal joints: A-P _____
Intermetatarsal glide: _____
Metatarsophalangeal dorsiflexion (with associated plantar flexion of each toe) _____

Interphalangeal joints: long axis distraction _____ A-P glide _____
lat and med glide _____ rotation _____

Special tests

Anterior drawer test _____
Talar tilt _____
Thompson test _____
Homan sign _____
Tinel's sign _____
Subtalar neutral position _____
Balance/proprioception _____
Test for rigid/flexible flatfoot _____

Alignment

Heel to ground _____
Feiss line _____
Tibial torsion _____
Heel to leg (subtalar neutral) _____
Forefoot to heel (subtalar & Midtarsal neutral) _____
First ray alignment _____
Digital deformities _____
Digital deformity flexible _____

Palpation

Anteriorly

Medial malleoli _____
Med tarsal bones, tibial (post) artery _____
Lat. malleolous, calcaneus, sinus tarsi, and cuboid bones _____
Inferior tib/fib joint, tibia, mm of leg _____
Anterior tibia, neck of talus, dorsalis pedis artery _____

Posteriorly

Calcaneus _____
Achilles tendon _____
Musculotendinous junction _____

Plantarily

Plantar muscles and fascia _____
Sesamoids _____

APPENDIX D

NUMERICAL PAIN RATING SCALE 101.

Patient Name: _____

File number: _____ Date: _____

Please indicate on the line below the number between 0 and 100 that best describes the pain of your major problem at this point, when it is at its WORST.

A zero (0) would mean "no pain at all" and one hundred (100) would mean "pain as bad as it could be".

Please write only one number.

0 _____ 100

Please indicate on the line below the number between 0 and 100 that best describes the pain of your major problem at this point, when it is at its LEAST.

A zero (0) would mean "no pain at all" and one hundred (100) would mean "pain as bad as it could be".

Please write only one number.

0 _____ 100

APPENDIX E

MEASUREMENT OF PAIN

SHORT-FORM MCGILL PAIN QUESTIONNAIRE

Ronald Melzack

Patient's Name:..... Date:.....

	(0) <u>NONE</u>	(1) <u>MILD</u>	(2) <u>MODERATE</u>	(3) <u>SEVERE</u>
THROBBING	[]	[]	[]	[]
SHOOTING	[]	[]	[]	[]
STABBING	[]	[]	[]	[]
SHARP	[]	[]	[]	[]
CRAMPING	[]	[]	[]	[]
GNAWING	[]	[]	[]	[]
HOT-BURNING	[]	[]	[]	[]
ACHING	[]	[]	[]	[]
HEAVY	[]	[]	[]	[]
TENDER	[]	[]	[]	[]
SPLITTING	[]	[]	[]	[]
TIRING-EXHAUSTING	[]	[]	[]	[]
SICKENING	[]	[]	[]	[]
FEARFUL	[]	[]	[]	[]
PUNISHING-CRUEL	[]	[]	[]	[]

The descriptors 1-11 represent the sensory dimension of pain experience and 12-15 represent the affective dimension. Each descriptor is ranked on an intensity scale of 0 = none, 1 = mild, 2 = moderate, 3 = severe. Copyright 1984 Ronald Melzack.

APPENDIX F

FOOT FUNCTION INDEX

INSTRUCTIONS: Please fill in a value somewhere between 0 and 10 describing your pain.
0 indicates no pain and 10 indicates the worst pain.
If the question is not applicable then indicate this by writing N/A next to it.

Section A:

Worst pain	0 1 2 3 4 5 6 7 8 9 10
Morning pain	0 1 2 3 4 5 6 7 8 9 10
Pain walking barefoot	0 1 2 3 4 5 6 7 8 9 10
Pain walking with shoes	0 1 2 3 4 5 6 7 8 9 10
Pain standing with shoes	0 1 2 3 4 5 6 7 8 9 10

Section B: Can you:

Walk in the house	0 1 2 3 4 5 6 7 8 9 10
Walk outside	0 1 2 3 4 5 6 7 8 9 10
Climb stairs	0 1 2 3 4 5 6 7 8 9 10
Descend stairs	0 1 2 3 4 5 6 7 8 9 10
Stand on tip toe	0 1 2 3 4 5 6 7 8 9 10
Get up from a chair	0 1 2 3 4 5 6 7 8 9 10
Climb curbs	0 1 2 3 4 5 6 7 8 9 10

ALGOMETER READINGS

FILE NO.: _____ GROUP: _____

VISIT NO.	DATE	BEFORE	AFTER
1)			
2)			
3)			
4)			
5)			

APPENDIX H

INFORMED CONSENT FORM

(To be completed in duplicate by patient/subject*) *Delete whichever is not applicable.

TITLE OF RESEARCH PROJECT:

NAME OF SUPERVISOR:

NAME OF RESEARCH STUDENT:

PLEASE CIRCLE THE APPROPRIATE ANSWER

- 1. Have you read the patient information sheet? YES / NO
- 2. Have you had an opportunity to ask questions regarding this study? YES / NO
- 3. Have you received satisfactory answers to your questions? YES / NO
- 4. Have you had an opportunity to discuss this study? YES / NO
- 5. Have you received enough information about this study? YES / NO
- 6. Who have you spoken to? _____
- 7. Do you understand the implications of your involvement in this study? YES / NO
- 8. Do you understand that you are free to withdraw from this study? YES / NO
 - a) at any time?
 - b) without having to give a reason for withdrawing, and
 - c) without affecting your future health care.
- 9. Do you agree to voluntarily participate in this study? YES / NO

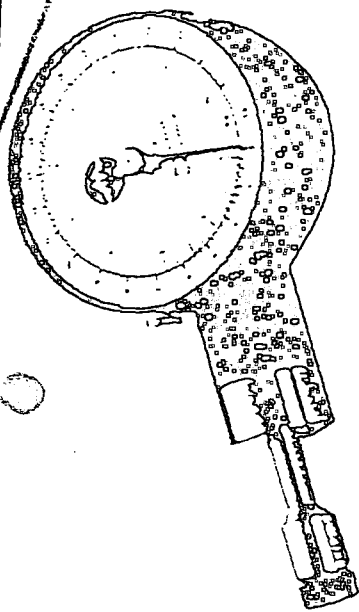
PATIENT/SUBJECT* Name _____ Signature _____
(in block letters)

PARENT/GUARDIAN* Name _____ Signature _____
(in block letters)

WITNESS Name _____ Signature _____
(in block letters)

RESEARCH STUDENT Name _____ Signature _____
(in block letters)

APPENDIX I



Activator Methods, Inc.

3714 E. INDIAN SCHOOL RD. PHOENIX, AZ 85018
16021 224-0220

ALGOMETER INSTRUCTIONS

Background:

Pressure pain threshold (PPT) has been used by many authors to quantify palpatory pain findings for myofascial trigger points and pain over bone using an algometer (1-7).

Description:

The pressure algometer consists of a force dial which reads in pounds or grams and a 1 cm diameter rubber-tipped stylus. Pain threshold is determined by the amount of force/cm² required for a person to first perceive pain.

Procedure:

Prior to recording the pain threshold, discuss the procedure with the patient. Before taking a measurement, you may wish to demonstrate the process to the patient by passing the algometer into the palm of their hand.

1. Localize any sensitive areas you wish to measure by gentle but firm palpation.
2. Hold the meter in the palm of your hand with your thumb and index finger.

measure. Make sure the force dial is perpendicular to the skin surface. Stabilize any nodular muscular regions between the middle and index finger of your indifferent hand.

4. Apply steady, gentle pressure at a rate of 1kg/cm²/sec. until the patient first feels pain and responds by saying "now."
5. Remove the stylus and record the value and locations of the tender areas in your notes or on a diagram for follow-up examination.
6. Reset the meter prior to making another reading.

References:

1. Fischer AA. Pressure algometry over normal muscles: Standard values, validity, reproducibility of pressure threshold. *Pain* 1966; 30:115-126.
2. Hsieh J, Hong CZ. Effect of chiropractic manipulation on the pain threshold of myofascial trigger point: a pilot study. Presented at the FCER's 2nd Annual International Conference on Spinal Manipulation, May 11-12, 1990, Washington, D.C.

GENERAL INFORMATION

The algometer is most accurate in the range which is 75% from full scale. In the range below 25% of full scale, the gauge will give consistent readings, however, with less accurate results. This inaccuracy is inherent to the design of mechanical gauges. (Note: several studies have demonstrated reliability in a clinical setting.)

The algometer requires no lubrication or other form of service.

The face of the meter has no zero setting because the zero has no significance in the calibration or accuracy of the gauge.

CALIBRATION

Activator Methods certifies that all algometers have been properly calibrated and are accurate to $\pm 1\%$ of full scale. The calibration of the algometer may be checked by attaching the pull hook and suspending test weights at 1/4, 1/2, 3/4, and full capacity in the vertical position. The weight of the plunger, dial, and pull hook (15 g.) should be subtracted from the test results. If it is determined that calibration is required, the instrument should be returned to the factory.

Annual International Conference on Spinal Manipulation, March 31-April 1, 1989, Washington, D.C.

4. Osterbauer PJ, Funnr AW, DeBoer KE, et al. Preliminary clinical and biomechanical assessment patients with chronic sacroiliac syndrome. Presented at the FCER's 2nd Annual International Conference on Spinal Manipulation, May 11-12, 1990, Washington, D.C.
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THIS INSTRUMENT CARRIES A
ONE YEAR WARRANTY